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SOME OBSERVATIONS ON CERTIFIED PERENNIAL RYE-GRASS IN CANTERBURY, OTAGO, AND SOUTHLAND.

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THE first certified perennial rye-grass seed was sown in the South Island in 1929 and since then there has been a steady increase in the acreage sown. At the present time approximately 10,000 acres have been sown and harvested for seed in the South Island under certification, and at a conservative estimate a like acreage has been sown for ordinary grazing purposes. In view of this increasing area a survey of the performance, possibilities, and limitations of the certified strain of perennial rye-grass in the South Island will be of considerable value; moreover, in view of the fact that practically all the stock mother seed for the sowing-down of this area in the South has been grown in Hawke's Bay and Poverty Bay districts, and in view of the prevailing thesis that "home-grown seeds are best," an analysis of the behaviour of the certified type as against locally produced types is of added interest.

FIELD-PLOT TRIALS.

Fifty-eight large field-plot trials of rye-grass types have been laid down in various parts of New Zealand, and these cover not only a full geographical and climatic range, but also a considerable range of varying soil-types.

Trials at the Plant Research Station, Palmerston North, resulted in the adoption of the following classification of commercial perennial rye-grass types:—

Type 1. New Zealand certified perennial.

Type 2. British indigenous perennial.

Type 3. Good false perennial—the best of the South Island types and the best British commercial.

Type 4. Average false perennial—typical of the general run of South Island perennial and poorer lots of British commercial.

Type 5. Bad false perennial representative of the worst commercial "perennial" rye-grass offered for sale.

Type 6. Italian rye-grass sold as perennial rye-grass.

Prior to laying down any of the above fifty-eight field-plot trials, the rye-grass type was determined by trial at Palmerston North, and in very many instances seed actually from the same line of each type was sown at each centre. Throughout these trials also, the same amount of seed and manure per acre was used. The following table shows the relative persistency of the various types at approximately two years after laying down. The figure 100 is a relative figure merely, and is employed to represent the most persistent type in any one experiment.

Location of Experiment.	Type 1.	Type 2.	Type 3.	Type 4.	Type 5.	Type 6.
North Island ..	100	..	70	57	29	20
South Island ..	100	..	72	55	21	10

The figures in the above table serve to show not only the relative behaviours of the main New Zealand perennial rye-grass types, but also that the behaviour of those types is identical, or almost so, when grown in the South Island as compared with the North Island. The New Zealand certified perennial rye-grass (type 1) is the most persistent perennial rye-grass irrespective of where these trials have been conducted in New Zealand.

General Considerations.

In the launching of a project that has as its objective the replacement of one existing strain of any one grass or clover with another of an entirely different type and from an entirely different source, there is bound to be criticism arising, firstly, out of a deep-seated parochialism, and, secondly, because of a mistaken view that the new strain supplied is suitable for all soils, climates, and management conditions to be met with on farms. The experience of the South Island during the past decade at least in so far as ordinary rye-grass is concerned is based largely on annual types. Such types establish quickly and are highly productive of feed for the first year, and the feed produced is highly palatable and nutritious. In a great many cases, also, where the local strain has been used even though the perennial rye-grass is of a fairly good type the farmer has been using mixtures of strains with or without associate species rather than pure sowings of a pure strain. New Zealand certified perennial rye-grass is relatively a pure strain and it has been sown pure largely for seed-production purposes.

Mixtures versus Pure Swards.

It seems that it can be generally accepted as a world-wide truth that pure sowings of any one species or strains will not make such a good pasture as a mixture of species or strains where wide seasonal differences are apparent in the growth of any two or more species or strains. Another feature in regard to the mixture concept as distinct from the pure-sward concept arises in the ecological fact that unless the pure sown species is thriving well, volunteer species may assert themselves and such volunteer species may produce infinitely more feed than the sown species under the conditions ruling for its growth. Or in the case of a mixture sown, the habitat may be admirably suited for one

or more species in the mixture and unsuited for others. Consequently there will be a rise to dominance of that species in the mixture which is best attuned to the conditions ruling, and this is true irrespective of any high-quality attributes of any particular strain of the species used. It is quite conceivable that in many soil-types volunteer growth will produce more feed than the actual pure species or mixtures sown, and in such a case the use of a short-lived, low competitive strain in comparison with a persistent highly competitive strain will permit of a full volunteer growth asserting itself more quickly in the case of the annual short-lived strain than in the case of the persistent strain. Hence the resultant pasture may be better in the case of the short-lived strain than in the case of the persistent strain, not because of the relative merits of each strain in themselves, but because the one permitted faster ingress of volunteer species than the other. This is very clearly marked in all our trials in relation to strains of rye-grass and white clover. It is true also in relation to cocksfoot and such second-rate pasture grasses as brown-top, Yorkshire fog, sweet vernal, &c. The New Zealand certified rye-grass, owing to its persistent and highly competitive nature, is relatively prejudicial to the establishment, spread, and development of white clover, cocksfoot, brown-top, &c., when compared with the annual short-lived type of rye-grass, and it is manifest that where we are farming on country in a state more suitable to white clover, or cocksfoot, or brown-top than it is to rye-grass, then the slowing-up of the establishment, spread, and development of white clover, or cocksfoot or brown-top may result in a lower producing pasture where certified rye-grass has been used in comparison with the case where short-lived annual rye-grass types have been employed. Thus under grazing one strain of rye-grass may appear better than another not in virtue of its own inherent qualities, but on account of its reaction on the other members of the sward.

Further, in a mixture of species where we are dealing with sown certified, sown non-certified, or with volunteer species, there are seasonal fluctuations in growth of each species or strains in the sward, and we may take it that the most efficient mixtures devised are those where there is a series of peaks of production as a result of the component species or strains coming to their individual production peak at different times. Thus in the case of a mixture of Italian rye-grass, perennial rye-grass, cocksfoot, white clover, and Montgomery red clover, the Italian rye-grass forms the first peak, the perennial rye-grass and white clover the second, cocksfoot and white clover the third, cocksfoot and Montgomery red clover the fourth, and in the autumn again the rye-grass (provided it is a persistent strain) reasserts itself and carries on through the winter and early spring. It is obvious that should one or other of these species be omitted from the mixture, or should it fail to establish, the total seasonal production will be less, and what is produced will be poorly spread throughout the entire growing season. Thus it will be seen pure rye-grass pastures, irrespective of the strain sown, are at a disadvantage in comparison with another strain of rye-grass sown out with cocksfoot, white clover, and Montgomery red clover, and in any comparisons made on the farm between one paddock and another this fact must be carefully borne in mind. For instance, in Canterbury pure sowings of certified perennial rye-grass have been compared with older mixed

FIG. 1. RYE-GRASS STRAIN TRIALS IN CANTERBURY ON PROPERTY OF MR. HUNTER MORRIS, WINCHMORE.

Certified perennial rye-grass on the mid left compared with a short-lived South Island "perennial" rye-grass on right. Plots three years old.

FIG. 2. CLOSE-UP VIEW OF CERTIFIED PERENNIAL RYE-GRASS (LEFT) AND SHORT-LIVED FALSE PERENNIAL TYPE (RIGHT).

Note the ingress of sorrel where the annual type has run out. Plots three years old

[*Photos by E. Bruce Levy.*

pastures of rye-grass, white clover, cocksfoot, &c., and it is only to be expected that the comparison will be unfavourable to the pure sowing made with certified seed.

Swards for Seed-production.

The foregoing remarks apply particularly to pastures laid down for grazing purposes. Where seed-production is the main consideration of the farmer, he must necessarily sacrifice the pasture-sward ideal and aim at a seed-production method that gives the maximum seed crop at the least expense, and for this purpose the pure sward is the best. With somewhat more difficulty attendant harvesting a dual-purpose seeding may be made, and where a seed-grower is also a grazier the dual mixed-seed pasture should be the aim, but in such a crop there is likely to be a smaller seed crop of any one species and a correspondingly greater cost in harvesting. The added value of the pasture for the remaining eight or nine months of the year, however, should more than compensate for the lower seed yields. The point of importance, however, is that seed-production as a business must necessarily sacrifice the ideal of the grazing-pasture sward, and in taking cognizance of the behaviour of certified rye-grass in the South Island this fact must be borne strongly in mind in the notes that follow for the main districts of the South Island.

Position in Canterbury, Marlborough, and Drier Parts of Otago.

Canterbury, North Otago, Marlborough, and the moister parts of Central Otago are relatively the dry areas of the South Island, and the considerations given towards the maintenance of perennial rye-grass, and, for that matter, for truly permanent pastures of first-class species, are somewhat different from those for Southland and South Otago, where the rainfall is always adequate for the full development of these high-production species. The two essentials wherever perennial rye-grass is grown are the building-up of a high standard of soil-fertility and a high per-acre stock concentration to ensure full utilization of the feed produced and to secure as a result of this high per-acre stock concentration two or three dressings per year over the grassed portions of the farm of stock manure containing readily available nitrogen, which is all-essential to the health, vigour, and growth of perennial rye-grass. Perennial rye-grass more than any other species thrives under this hoof treading, and manuring of stock. One has only to recall to mind the night paddock for dairy cows—often stock manured to a wasteful extent—the wool-shed holding-paddock, pig-grazing pens, and those areas of dominant rye-grass through the gateways of paddocks on the farm or on roadways and tracks used as highways for stock. In the trial grounds at Palmerston North it is almost impossible to keep healthy rye-grass in the broadcast sward after the first year unless those areas are grazed by stock.

High per-Acre Stock Concentration Thesis.

Perennial rye-grass then will thrive relatively on the farm according to the stock-carrying capacity of the farm—the higher the stock-carrying capacity of a farm the more and more dominant perennial rye-grass becomes—*i.e.*, provided always the stock are fully

fed and not starved on the area—and, as a corollary to this, the more perennial rye-grass growing well on the farm the higher the stock-carrying capacity. Perennial rye-grass is an almost perfect soil-fertility index within grazed pastures. It is extraordinarily sensitive to rise and fall of available soil-fertility and more particularly in regard to available nitrogen.

This thesis that nitrogen from stock is the most potent factor for the growth and well-being of rye-grass, and, for the matter of that, of most grasses on the farm, would appear to have as its fulfilment a prodigious future in the vast possible maximum stock-carrying capacity of the grassed portions of the farm. It would appear, given a stock concentration of, say, one dairy cow or six to eight ewes per acre as the year round carrying-capacity of the grassed portions of the farm, that sufficient stock nitrogen is excreted by the animals to nourish the grasses as far as the all-essential nitrogen is concerned to

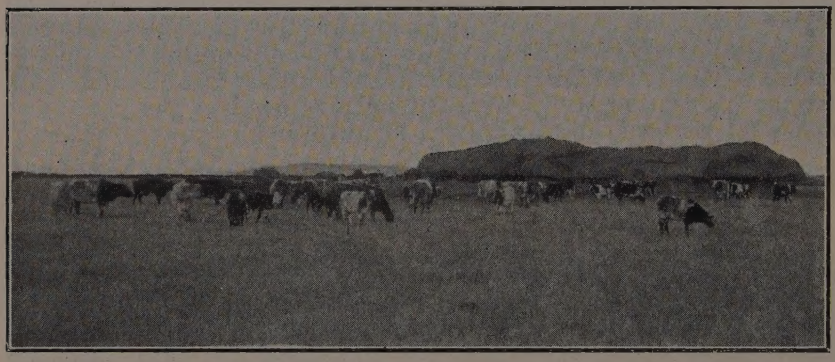

FIG. 3. A HIGH PER-ACRE STOCK CONCENTRATION ON AFTERMATH OF SEED CROP ON PROPERTY OF MR. R. ANDERSON, KAUANA, SOUTHLAND.

Twenty-three Timothy seed crops in twenty-five years were taken off this area, and each year the threshed straw was converted into stock-manure by cattle. This stock manuring was largely responsible for healthy state of the pasture and enabled seed crops year after year to be taken.

[*Photo by E. Bruce Levy.*

a point where they are producing their maximum, and the maximum possible production from grass will not be secured until the grassed portions of the farm are carrying this high per-acre stock concentration. About this thesis may be postulated, where the possible maximum production of the farm is aimed at, the relationship of (1) area of the farm in grass to that in special supplementary fodders that must be grown in order to provide on the grassed portions this high per-acre stocking; or (2) the amount of artificial fertilizers, where these are effective, that are necessary where hay and silage from grass is the only supplementary crop grown on the farm; or (3) the amount of concentrate feeding in order to carry the stock on grass during the low-production period. The thesis really asserts that unless the grassed portions of the farm are carrying a high per-acre stock concentration, full utilization of the area of the farm is not being made. It asserts that on many farms supplementary cropping,

coupled with more efficient manuring of the remaining grass, should replace a good many acres of the farm now in low-producing grass. On hill country the ploughable paddocks should carry more crops, and the more convenient at least of the hill pastures should be top-dressed so that there may gradually come about a higher and higher stock concentration on the grassed portions of the farm.

It will, of course, be obvious that the high per-acre stock concentration thesis has its dangers from the point of view of (1) overstocking in relation to the available stock-foods on the farm, and (2) from the point of view of disease. In the former case it must be borne clearly in mind that nothing is more detrimental to the well-being of the sward than close and continuous overgrazing. It reduces production and increases the weed population of the pasture. The high per-acre stock concentration thesis presupposes ample supplies of stock-foods available on the farm to cater for the full requirements of the stock carried. In the case of disease the high per-acre stock concentration thesis does not necessarily presuppose unduly long-duration pastures, but it does presuppose that those pastures should be stocked heavily while they remain down. Stock troubles such as blowing in dairy cattle would be less under a high per-acre stocking than under light stocking, for the reason that there is likely to be a better grass to clover balance in the high stock-carrying portion than in the case of relatively low stock-carrying portions of a good average farm. Phosphate or potash manuring under relatively light stocking brings an overabundance of clover, whereas under a high per-acre stocking the additional stock nitrogen grows grass, and particularly rye-grass, rather than clover.

The clover of the sward, however, and more particularly white clover, is the major factor in securing an ultimate high stock concentration per acre where supplementary crops are not extensively grown or where inbrought food-stuffs are not used. Clover in the sward ensures a more profitable exploitation of phosphates, the added growth of the clover through phosphate (or potash) manuring enabling more stock to be held on the farm, which means more waste animal excreta containing quickly available nitrogen that is so essential for the growth and well-being of the grass.

A point also that is worth mentioning in regard to this supply of nitrogen from stock, in seed-producing areas, is the disposal, per medium of stock held on the seeded area, of the threshed straw that at present stands in stacks unconsumed—monuments to the drain of the essential fertility of the soil. It is apparent on farms where an effort has been made to utilize this straw per medium of the animal that there is a marked improvement in the growth of the rye-grass stubble wherever the consumption of such straw by stock has taken place on the area. The rye-grass in the environs of a stack is usually strong and healthy, and this extends outward from the stack, corresponding to the amount of the stack that has been consumed. There is no doubt when stacks are consumed *in situ* there is far too much stock excreta deposited in the immediate neighbourhood of the stack, and if it were practicable to chaff the straw and feed it out in troughs mixed with a little oaten chaff or meal, a much better distribution of the animal excreta would be secured. The greater use of lucerne to provide winter feed in the form of hay for feeding out on the permanently

grassed areas of the farm, or using the grassed areas as run-offs from turnips, rape, &c., would also provide another means of raising the stock-carrying during the winter on the grassed portions of the farm.

The question of how general this practice of feeding out on to grass can become in the drier areas of Canterbury, North Otago, Marlborough, and Central Otago at least, in the writer's opinion, predetermines the area such farmers may have in permanent high-production grassland. High-production perennial pastures are possible only under perennial manuring, and in the drier districts of the South Island there is sufficient rainfall to render available only a small quantity of any artificial manures that may be applied. Hence fertility upbuilding to a perennial rye-grass standard does not seem possible by the use of artificial manures alone. It is possible to raise the soil fertility per medium of soluble stock manure (urine) on soils too dry for artificial manures to become available to the plant, and on the extent of this practice is determined what area of the farm may be laid down to permanent grass. Winter feeding with inbrought food-stuffs—roots, hay, or concentrates—may in many instances pave the way for the ultimate establishment of good perennial pastures that are laid down to certified seeds, and where seed-production is part of the farm routine this practice may be quite justified in the resultant grass-seed crop secured. It must be borne in mind, however, that if hay or chaff containing Italian or false perennial rye-grass is fed on to certified rye-grass paddocks, there is a big danger that these areas will be rejected for certification on account of the Italian or false perennial rye-grass that may become established on the area as a result of the feeding-out.

Artificial Nitrogen.

The use of artificial nitrogen is valuable for seed-production purposes in a season when there is sufficient moisture to make it available. Throughout Canterbury, particularly, autumn stubble manuring with superphosphate and lime, the stubble being well cleaned up in the winter, and a top-dressing at closing-up time with 1 cwt. of sulphate of ammonia per acre, has given good payable seed crops, whereas without such manuring a total failure of the crop could be expected, unless of course the area had been well fertilized by stock nitrogen as outlined above.

Seed-production on Drier Areas.

Because a soil will not grow permanently a true perennial rye-grass this fact need not preclude a seed-grower sowing for seed-production purposes. The " once-growing " of certified mother seed is a possibility on almost any soil in Canterbury, North Otago, and the moister parts of Central Otago despite the small rainfall often experienced. The ameliorating influence of breaking-up and of cultivation frees plant-foods locked up in the soil, and the greatly increased water absorption and water-holding capacities of cultivated and mulched soil, together with the fact that fertilizers applied at time of seeding down are worked deeper into the soil in contact with soil-moisture, all aid materially in the successful growth of the crop during the first year whilst these influences are operative. Hence the production of first harvest seed carries with it little risk of failure to secure a seed crop, and there is the possibility in the drier areas of Canterbury

and North and Central Otago that first-harvest seed-production of certified perennial rye-grass would be a highly payable venture, the area being ploughed over after the crop has been harvested, as one would normally do in taking an annual crop such as wheat, turnips, Italian rye-grass, &c. When the crop is carried on to the second year failure in a dry or non-fertile area will surely result unless some top-dressing and high stock concentration plan as indicated above is put into effect.

Certified Rye-grass of Great Value

Taking Canterbury, North Otago, and the moister parts of Central Otago as a whole, there is ample evidence to convince the writer that certified rye-grass as a major component part in a mixture is a splendid thing wherever pastures over two years are in demand. It will increase the carrying-capacity from 10 per cent. up to 50 per cent. at a very moderate estimate, and will enable the farmer to

FIG. 4. CERTIFIED PERENNIAL RYE-GRASS IN SOUTH CANTERBURY.
Ewes and lambs doing well on property of Mr. S. McKenzie, Timaru.
[*Photo by E. Bruce Levy.*

draw up his crop-pasture rotation with much more confidence than he has been able to do previously because of the unreliable nature of the commercial rye-grass seed that has been available for his use in the past. As a seed crop it offers to these districts a profitable and secure industry.

It is believed, however, that farmers in Canterbury, North Otago, and Central Otago must themselves decide whether they really want a perennial or an annual as the basis of their grazing pastures. The more arable the farming and the shorter the rotation, the greater is the call for the annual and short-lived species. The less arable the farming and where the effort is to secure a longer pasture phase in the rotation the greater the need of a true perennial, and it is to this latter group—which, after all, is a very large group—that certified strains of perennial rye-grass and other species will come as the greatest boon. There is, however, a small number of farmers, in North Canterbury more particularly, who have maintained a good strain of perennial rye-grass by careful husbandry and who have

perpetuated this strain over a long period of years. The seed of such growers is always in local demand—emphasizing the value of a true perennial to Canterbury itself—and to these people the certified rye-grass means less than to the majority of the South Island who rely entirely on open market seed. Nevertheless there is every indication that certified seed to the South Island as a whole will mean that a greater confidence may be placed in the pasture phase of whatever rotation best fits the peculiar needs of the land.

Position in South Otago and Southland.

It is probably a sound prophecy that certified perennial rye-grass, and certified white clover when supplies of the latter become more readily available, will mean more to Southland and the wetter portions of Otago than to any other district in the South Island. The opportunities for the development of first-class high-production permanent pastures in Southland particularly are enormous. Granted at the moment the production of Southland is high, even with so much poor rye-grass in use and so much run-out pasture in evidence, it but serves to indicate the progress that is possible when a general swing over to certified types of rye-grass and white clover is made. The great asset of these southern districts is the good grassland climate and a plenteous rainfall. Given these two assets, together with cheap artificial manures and good reliable strains of perennial species to form the basis of the sward, then grassland farming is what the farmer likes to make it: he has the moulding of the sward in the hollow of his hands. The building to a high stock concentration in Southland is for the most part highly practicable, and, as cited above, one has only to reach a state of a perennial high per-acre stocking and sward-improvement becomes certain.

Rye-grass Seed-production in Wet Climates.

The use of certified perennial rye-grass has received in its initial introduction a serious set-back in Southland owing largely to the fact that this strain produces a seed crop of a low germination capacity when grown for seed in a humid or wet climate. In the production of true perennial rye-grass it would appear, in order to get seed quality—*i.e.*, high germination and seed bulk appearance—that the seed crop must be produced in relatively dry areas rather than in wet, apart altogether from the difficulties of harvesting in a moist or wet climate. It would appear from the researches of E. O. Hyde* that under moist climatic conditions during the development of the grain, fungal injury leads to the death of the germ and consequent reduction in germination capacity of the line, and there is now sufficient evidence to show that the true perennial rye-grass strains are more susceptible to injury by this fungus than Italian rye-grass and false perennial rye-grass, particularly those hybrid lots that have affinities with the Italian parent rather than with the perennial parent. Prior to certification the dominant rye-grass type harvested for seed in Southland was Type 4 and Type 5, hybrid lots that resemble Italian rather than perennial, and that have an exceedingly short life even when grown in Southland. The experience in Southland with three harvests of certified

* *Journal of Agriculture*, May, 1932, pp. 316–319.

rye-grass gives little encouragement at present for the future of Southland as a seed-producing area as far as the true perennial rye-grass is concerned, whether this be the certified type or a good type of perennial rye-grass of Southland origin. It is fairly common knowledge in the seed trade in Southland that old pasture Southland seed does not germinate on the whole as well as does the general run of maiden seed, the vast majority of which is of a bad false perennial type. There is, of course, a possibility that strains of true perennial rye-grass may be produced by selection and breeding which are resistant to this fungal growth; but, until work along these lines has progressed further, it is obviously too risky in a wet climate like Southland to recommend large-scale seed-production for true perennial rye-grass. Nevertheless, it would appear fairly definite that certified seed even of low-germinating capacity will make an eminently satisfactory pasture if seeding adjustments are made so as to give in the sowing from 20–25 lb. of viable rye-grass seed per acre. There is increasing evidence to show that less seed per acre is required of certified perennial rye-grass than with the ordinary commercial seed, because of the persistency of established plants and their greater tillering habit. In the plot trials at Palmerston North where 40 lb. per acre of all lots of rye-grass are sown, low-germinating lines of certified rye-grass grown in Southland were sown out alongside high-terminating lines of ordinary Southland seed, and in the second year the lines of certified rye-grass, germinating as low as 20 per cent. were making better pastures than lines of ordinary Southland germinating 98 per cent. Further, in another trial a 5-lb.-per-acre seeding of a high-germinating line of certified rye-grass gave in the second year a better stand of rye-grass than plots of ordinary Southland sown respectively with 5 lb. 10 lb., 20 lb., 40 lb., 80 lb., 100 lb., and 200 lb. of a high-germinating seed per acre. This fact is also true in Southland itself. Farmers there have sown their own low-germinating certified seed (as low as 7 per cent. germination) and the pastures are developing so well as to create the impression that the official germination figure given for the line sown does not represent the true field-germination capacity of the seed. The field-plot trials conducted at Palmerston North in connection with certification confirm the Seed-testing Station test in virtually all cases, and when adjustments in quantity are made in the seeding rate normal stands are secured, but a thin strike results corresponding to the Seed-testing Station germination figures if low-germinating lines are not adjusted at time of seeding. As mentioned above, however, thin seedings of the persistent, high-tillering certified strains soon build up to a fairly good sward, so that in the course of time the initial weakness in the sward is to a large extent eliminated. It is noted, however, in field trials that in very low-germinating lines—*i.e.*, as low as 10 per cent., if the line is sown ten times the normal rate frequently the take is too thick. This may be explained from the fact that the figure for low germinating lines is apt to vary between wider margins than in the case of higher germinating lines, largely as a result of the operation of the law of chance in sampling for the germination test, and when adjustments on the average figure are made and when those adjustments are a high multiple, obviously it is easy to sow double the amount of seed in making the adjustment. Thus in a line germinating from 0 to 10 per cent. in the duplicate counts of 100 individual seeds, obviously if this is

adjusted on the average figure—*i.e.*, 5 per cent.—this means the multiple figure is 20. If, on the other hand, the true germination, if enough seeds were taken, were nearer 10 per cent than 5 per cent. this would mean that an overadjustment to the extent of double the seed had been made, and obviously the stand would be thicker than in a normal seeding. Low-germinating seed, however, must be regarded as a serious detriment from the trade point of view, and such seed cannot compete with high-germinating seed from the drier areas of the South Island when it comes to growing the crop for sale outside the bounds of Southland or South Otago itself. There is, however, no reason why Southland should not grow seed of certified rye-grass for its own requirements; but until such time as a high germinating seed may be produced there at comparatively little risk of failure, the writer cannot recommend in the wetter parts of Southland and South Otago rye-grass for seed-production other than for its own requirement. From the grazing point of view, however, Southland should be a large user of certified perennial rye-grass.

Acclimatization Thesis.

There is in Southland to-day a rather prevalent opinion that the germination capacity of certified rye-grass will improve just so soon as the strain becomes acclimatized to Southland conditions. The thesis that "home-grown seeds are best" is at heart based on an ecological concept which may be termed "acclimatization." It seems that the certified rye-grass now being sown in Southland will adapt itself in twenty to thirty years to the climatic and soil conditions of Southland, but I am also of the opinion that when this does take place the strain as a grazing proposition will not be so useful to Southland as will the direct importations from such districts as Hawke's Bay and Poverty Bay. There is no question that the climatic conditions in Hawke's Bay and Poverty Bay permit a longer seasonal growth in a species or strain than will those of Southland, and it would appear from a study of world types that there is bred into a strain when grown under a climatic and soil condition that permits of a long seasonal growth, a long-seasonal-growth characteristic, which characteristic the plant endeavours to reproduce even when placed under somewhat more severe climatic conditions. There is some evidence in Southland, for example, to show that the certified strain of rye-grass is earlier to start growth in the spring and is later to cease growth in the autumn than the present acclimatized strain of perennial rye-grass of Southland itself.

Certified Rye-grass for Grazing.

The fact that seed of a high-germination capacity cannot be relied on has led to bitter disappointment in Southland over certified rye-grass, yet when we consider the vast possibilities in Southland in regard to wool, fat lamb, and dairying, by the general adoption of certified perennial rye-grass, together with certified white clover, as the mainstay of their grazing pastures, it will be realized that the improved grazing pasture, as a result of a more permanent perennial rye-grass, will soon more than compensate for the loss of the perennial rye-grass seed crop, did this happen in its entirety. The estimated

value of the perennial rye-grass seed crop in 1932–33 is £21,886. Southland at present carries, according to the official statistics for the year 1932–33, 2,065,942 sheep with 1,530,535 lambs, 192,170 cattle, of which 81,167 are milking-cows, 23,997 horses, and 14,526 pigs on 1,119,157 acres of sown grass and 125,298 acres of supplementary fodders plus 1,383,000 acres of native tussock plus some grazing from 72,362 acres of grain and pulse crops that may be fed off prior to shutting up to seed, plus a portion of the oat crop of 62,634 acres utilized as grain and chaff.

It is difficult to assess a per-acre stock carrying on the sown grasslands from these figures, but assuming all the stock excepting horses and pigs were carried on the sown grasslands plus supplementary fodder crops plus tussock, then 3,983,229 sheep (1 cattle = 6 sheep and 1 lamb = $\frac{1}{2}$ sheep) are carried on 1,119,157 acres of sown grass

FIG. 5. CERTIFIED PERENNIAL RYE-GRASS IN SOUTHLAND.

Ewes and lambs doing well on property of Mr. Wm. Hunt, at Titipua. Portion of 1,500 acres in certified perennial rye-grass and good strains of white clover.

Photo by E. Bruce Levy.

giving a per-acre stocking relative to the sown grasslands of 3·5 sheep per acre. If the thesis of a high per-acre stock concentration is sound, Southland should just double its sheep per acre in relation to the sown grasslands before it can be said that Southland is getting the possible maximum out of the country laid down to sown grass. Whether this be done (1) by increasing the amount of supplementary crops grown that are fed out more on to the sown grassland, (2) by feeding inbrought concentrate foods to stock held on the sown grassland, or (3) by a more universal programme of top-dressing (out of 1,119,157 acres of sown grass only 125,356 acres, or 11·2 per cent., are top-dressed) success will depend on whether a good strain of perennial rye-grass forms the basis of the sward. Certified rye-grass, in the writer's opinion, will make this objective possible, and there is evidence in Southland to-day that the amount of supplementary crops grown will be less than formerly, provided (1) certified perennial strains of grasses and clovers are sown, (2) top-dressing becomes more universal, and (3) that some judgment is shown in regard to

placing the root crops on the farm in such a way that they may be fed in conjunction with the sown grassland so as to transfer as much as possible of the animal residue from the crop consumed on to the sown grassland.

Southland at present grows 1 acre of roots or other supplementary fodders to 9 acres of sown grass. Individual farmers in Southland who have sown certified rye-grass and good strains of white clover and who top-dress regularly can winter well on the sown grass with round about 1 acre of turnips to 18 acres of sown grass. The point at issue, however, is whether top-dressing grass sown to good strains can give the high per-acre stock concentration in Southland more cheaply than can the use of roots or other supplementary crops. No doubt all of the three methods outlined—*i.e.*, (1) top-dressing, (2) growing roots and fodders, and (3) feeding inbrought foodstuffs—will play a part in raising the stock carried per acre of sown grass; and, when this is accomplished, provided good rye-grass strains are used, there will be a gradual building-up of the production from the grassland itself, which must considerably reduce the amount of special crops to be grown. The main point, however, is to raise and keep the sown grasslands to a high per-acre stocking. Certified perennial rye-grass will make the project practicable in Southland. The uncertified strains give place to brown-top, sweet vernal, Yorkshire fog, and weeds that are quite incapable of being built up to carry the necessary stock and such pastures do not respond the same to the stock-manuring even though the high stocking be attained by additional supplementary feeding.

There is also in Southland the 1,383,000 acres of tussock to consider. In the above remarks this is regarded as equivalent to so much supplementary feed in relation to the sown grasslands. Much of this tussock is ploughable country and hence capable of conversion to good sown grasslands, provided capital is available to break up, to liberally treat with lime and phosphate, and to sow the more expensive certified seeds: 5,208 acres of virgin country was sown to grass in Southland in the year 1932–33.

In the writer's opinion, therefore, not only can the sown grassland be greatly improved in Southland, but the area of this may be considerably extended, and the basis of that improvement and extension is certified perennial rye-grass and certified white clover, plus top-dressing, plus roots, plus plenty of stock.

Conclusion.

Certified perennial rye-grass in the South Island is behaving relative to treatment. In the drier areas of Canterbury and Otago success or failure of certified rye-grass depends on the stock concentration after the first year down. Where one-year stubble crops have been well cleaned up, where top-dressing has been applied, and where inbrought food-stuffs have been fed out, and where the threshed straw has been consumed on the area, the sward is healthy and vigorous and the strain everywhere persistent. Where there has been little or no stocking of the stubble aftermath the growth is scanty, yellow, and stunted, and distinctly unpalatable.

Certified perennial rye-grass in New Zealand at least is not excelled by any other perennial rye-grass, and, if it does not thrive, the fault lies not with the grass, but with its treatment, or with the soil-type on which it is grown. It can be said safely that the farmer may regard certified rye-grass as a means test of his soil-type and his grassland-farming capabilities—the better the soil conditions, the better the management; and the higher the stocking, the better the certified rye-grass grows.

THE FUNGI CAUSING ROTS OF STORED APPLES IN NEW ZEALAND.

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IN pursuance of investigations carried out by this laboratory into fungus wastage in cool stores, a study has been made during the 1931 and 1932 seasons, of the rots present on apples held in cool stores throughout the Dominion. Specimens were forwarded in case lots by the orchard instructors from cool stores at Auckland, Gisborne, Hastings, Greytown, Nelson, Christchurch, and Dunedin. Specimens from 109 consignments were received at the laboratory. Isolations were made from all rots present on these specimens, and most of the fungi responsible have been identified and studied.

The fungi isolated were: *Penicillium expansum* Thom., *Botrytis cinerea* Pers., *Gloeosporium perennans* Z. et Ch., *Glomerella cingulata* (Stonemn.) Spauld. et v. Schr., *Gloeosporium* sp., *Neofabraea malicorticis* (Cdly.) Jack., *Polyopeus purpureus* var. *verus* Horne, *Polyopeus* sp., *Fusarium lateritium* Nees var. *fructigenum* (strains 1 and 2), *Alternaria tenuis* Nees, *Pleospora* sp., *Isaria felina* (D. C.) Fries var. *pirina* E. and E. March., *Pullularia pullulans* Berkh., *Rhizopus nigricans* Ehr. and *Hormodendrum* sp. Of these *P. expansum*, *B. cinerea*, *G. perennans* (as Delicious spot), *G. cingulata* and *R. nigricans* have been recorded by Cunningham(1) as causing rots on stored pome fruits in New Zealand. With the exception of *G. perennans*, *N. malicorticis* sp. and *Isaria felina*, these fungi have also been isolated by Mrs. Kidd(2) and Miss Hellinger(3), from experimental consignments of New Zealand apples after arrival in England.

INOCULATION EXPERIMENTS.

During the period of cool storage, 1932, inoculations were carried out with these fungi on the varieties Jonathan, Cox's Orange Pippin, Delicious, and Sturmer. Apples secured every two months from time of picking till completion of storage, were inoculated* with spores or mycelium or both spores and mycelium inserted into incisions made with a sterile scalpel. The apples were then placed in moist chambers and kept at a temperature of 10°–15° C. The descriptions given of the lesions produced have been drawn from specimens inoculated thirty to forty days previously.

* Apples free from rots or blemishes were surface sterilized in acidulated mercuric chloride solution (1 grm. $HgCl_2$, 2·5 cc. concentrated HCl, 1 litre water) for five minutes, followed by a wash in boiled water for ten minutes.

Penicillium expansum Thom.—This fungus was present to the extent of 5·6 per cent. (average) in thirty-four consignments, all commercial varieties being infected. It produces (Fig. 1)* a lesion which appears first as a watery, pallid-brown, circular spot with clear-cut margin. This lesion develops rapidly, in a few days spreading through the entire fruit. Numerous coremia form on the surface of the lesion shortly after infection. These are at first pallid-green, later changing to dull blue-green. Inoculation experiments showed that *P. expansum* readily produced decay irrespective of variety or length of storage.

Botrytis cinerea Pers.—An average of 16·83 per cent. infection with this fungus occurred in twenty-eight consignments, all commercial varieties being infected. After inoculation (Fig. 2) an unequal brown area appears around the incision, and rapidly penetrates the entire fruit. The infected area remains firm, but the epidermis is thrown into slight ridges or folds. Ashy-grey fructifications appear only where the epidermis has been broken. *B. cinerea* was found to penetrate tissues of the four varieties irrespective of the length of time they had been held in the cool store.

Gloeosporium perennans Z. et Ch.—The writer(4) has shown that this fungus is the cause of "Delicious spot" in New Zealand. During the course of this investigation an average of 13·9 per cent. infection was secured from seventeen consignments, principally from the varieties Delicious and Sturmer, and to a lesser extent from Rokewood, Statesman, and Washington. Lesions (Fig. 3) are noticeable first as small, slightly depressed, light-brown spots, approximately 2 mm. in diameter. As they enlarge the centres become yellowish-brown, the periphery remaining light-brown. Lesions are usually circular in outline, but the size varies considerably, ranging from 2 mm. in diameter to 35 mm. on fruits held in cool store for four or five months. At first infected tissues are firm, but become spongy after keeping for several weeks. Penetration occurs to a maximum depth of 18 mm. On mature lesions acervuli appear. These are formed subepidermally, and after rupturing the epiderm. exude spores in dark-cream, gelatinous tendrils. Inoculations snowed that typical lesions were formed on fruits of the four varieties, irrespective of length of storage.

Gloeosporium sp.—This fungus is identical with cultures isolated at the Imperial Mycological Institute, by Miss Hellinger, from New Zealand apples of the varieties Cox's Orange, Jonathan, and Sturmer, and referred to as *Gloeosporium* "A" in her report(3). In New Zealand it has been isolated only from Delicious apples taken from an Auckland cool store, where it caused approximately 10 per cent. wastage. Lesions produced (Fig. 4) by this fungus are circular in outline, dry, slightly sunken, light-brown at the centre to dark-brown at the periphery, and attain a diameter of 30 mm. Penetration occurs to a depth of 22 mm. The affected tissues are soft and stringy. Fructifications of the fungus are rarely formed on infected fruits. Inoculations produced lesions on all four varieties irrespective of length of storage.

* All photographs were taken by Mr. H. Drake. These show apples thirty days after inoculation.

Glomerella cingulata (Stonemn.) Spauld. et v. Sch.—The conidial stage of this fungus occurs principally on fruit stored in packing-sheds prior to grading and packing, and becomes troublesome in cool stores only towards the latter end of the season. An average of 6·6 per cent. infection was obtained from eight consignments of the varieties Delicious, Sturmer, Statesman, Rokewood, and Spitzenburg. Lesions produced (Fig. 5) first appear as small light-brown spots which gradually increase in size, attaining finally a diameter of 40 mm. to 60 mm. Penetration occurs to a depth of 15 mm. to

FIG. 1. PENICILLIUM EXPANSUM ON STURMER, SHOWING COREMIA PRODUCED AFTER THIRTY DAYS. FIG. 2. BOTRYTIS CINEREA ON STURMER AFTER THIRTY DAYS. FIG. 3. GLOEOSPORIUM PERENNANS ON JONATHAN. FIG. 4. GLOEOSPORIUM "A" ON DELICIOUS.

25 mm. Lesions usually remain circular in outline, with even margins, their colour changes to dark-brown, and the centres become depressed. They are frequently marked by light and dark-brown concentric zones, which are later obscured by fructifications of the fungus. These appear in the form of acervuli, from which are produced pink, gelatinous spore masses. Lesions were readily produced on the four varieties at all stages in the storage period.

Polyopeus purpureus Horne, var. *verus*.—This fungus was first isolated from consignments of New Zealand apples in 1932 by Miss Hellinger, in England. During the two seasons under review

it was secured from apples taken from several cool stores in the Dominion. An average of 15·1 per cent. infection was obtained from nine consignments, an exception occurring in the case of one lot from Christchurch in which 50 per cent. of the fruit was found to be infected. The fungus is most frequently found on Sturmer, less commonly on Delicious and Jonathan. Lesions produced (Fig. 6) are dark-brown, circular, even in the margin, and 22 mm. to 27 mm. in diameter. The surface is sunken, and the infected tissues firm and rather dry. Penetration occurs to a depth of 15 mm. Fructification are rarely produced on the fruit, although occasionally subepidermal pycnidia, usually sterile, are formed. Inoculations showed that the fungus was only weakly parasitic on the four varieties during the earlier part of the season, but penetrated readily into fruits after they had been held in cool store for four months.

Polyopeus sp.—This species was isolated from fruits taken from two consignments held at Roxburgh, Otago. One consignment (Spitzenburg) showed approximately 8 per cent. infection, the other (Delicious) less than 1 per cent. Cultures were identified at the Imperial Mycological Institute as a species of *Polyopeus*, which did not match exactly any species or variety described by Horne(5). Lesions produced by this fungus (Fig. 7) are usually circular, slightly sunken, black in the centre merging to dark-brown at the periphery, and may attain a diameter of 50 mm. Affected tissues are moist and soft, and penetration may extend to the core. Numerous pycnidia, which are usually sterile, are produced subepidermally. The fungus produced lesions on the four varieties at all periods of storage.

Neofabraea malicorticis (Cdly.) Jack.—This fungus, the cause of north-western apple-tree anthracnose in the United States of America, rarely forms tree cankers in New Zealand, although it is not uncommon on apples held in cool store. An average of 5 per cent. infection was secured from six consignments, consisting of Delicious Sturmer, and Rokewood varieties, taken from cool stores at Nelson and Greytown. Lesions (Fig. 8) are circular in outline, slightly depressed, even in the margin, and may attain a diameter of 30 mm. to 40 mm. The infected tissues become dark-brown, but remain dry and firm. Penetration occurs to a depth of 25 mm. Acervuli are produced in abundance, are arranged in concentric zones, and exude spores in white gelatinous tendrils. Lesions produced by this fungus resemble those produced by *G. perennans*, but differ in that development is less rapid, and lack the yellowish-brown centre peculiar to those caused by the latter organism. Inoculations on the four varieties showed that lesions were formed at all periods of storage.

Fusarium sp.—Two strains of *Fusarium* have been isolated from occasional rotted apples. Both have been identified by the Imperial Mycological Institute as forms of *Fusarium lateritium*, var. *fructigenum*. Strain 1 was isolated from Delicious, Sturmer, and Jonathan, the percentage wastage being less than 1 per cent. Strain 2 was obtained from Delicious, Sturmer, Statesman, and Stayman's Winesap, on which varieties it caused the same percentage wastage. Both strains produce dark-brown, slightly sunken, circular lesions (Fig. 9)

which have regular margins, and which attain a diameter of from 19 mm. to 28 mm. Infected tissues are dry and firm. Penetration occurs to a depth of from 8 mm. to 10 mm. Fructifications of the fungus are not produced on infected fruits. Both strains were feebly parasitic at first on the four varieties (with the exception that strain 2 produced lesions on Jonathan); but pathogenicity increased after fruits had been stored for four months.

FIG. 5. GLOMERELLA CINGULATA ON STURMER. FIG. 6. POLYOPEUS PURPUREUS ON STURMER. FIG. 7. POLYOPEUS SP. ON JONATHAN. FIG. 8. NEOFABRAEA MALICORTICIS ON DELICIOUS. FIG. 9. FUSARIUM LATERITIUM VAR. FRUCTIGENUM (STRAIN 2) ON JONATHAN.

Alternaria tenuis Nees.—Alternaria-rot of apples, although widespread in other apple-growing countries, is rare in the cool stores of the Dominion, as two specimens only have been secured. At cool-storage temperatures *A. tenuis* produces small, dark-brown to black, superficial, dry spots. When inoculated apples are removed to higher temperatures, development is more rapid, and lesions are formed which are black in the centre to dark-brown at the periphery, sunken, circular, and with uneven margins. These may

attain a diameter of 20 mm., penetration being to a depth of 10 mm. Infection was not secured on three of the four varieties. On Jonathans, however, after four months' storage, lesions were produced which attained ultimately a diameter of 20 mm.

The following additional fungi were obtained from apples held in cool stores, but they occurred so rarely as to be of little economic significance :—

(1) *Pullularia pullulans*, following scald on Delicious.
(2) *Pleospora* sp., on Jonathan.
(3) *Rhizopus nigricans*, on Rokewood.
(4) *Hormodendrum* sp., on Spitzenburg.
(5) *Isaria felina* var. *pirina*, on Sturmer.

Additionally several fungi were obtained which remained sterile on all media, and consequently could not be identified.

Methods of Infection.

The fungi discussed usually penetrate through injuries, although in some cases infection was found to have occurred on uninjured fruits The usual points of entry are through injuries produced by stem punctures, insect damage, russeted surfaces, sun scald, spray burns, or branch injuries. Under certain conditions infection may occur by way of the lenticels, *G. perennans* and *P. purpureus* frequently penetrating in this manner.

In the following table is given a summary of the various points of entry on the 1,035 fruits examined during the investigation :—

Entry.	Percentage of Injury.	Type of Injury.
Skin-punctures ..	39·2	Injuries due to stem-punctures, case-injuries, nail scratches, &c.
Skin-injuries ..	15·6	Bruises and abrasions due to branch rubs, or careless handling during picking and packing.
Calyx entry ..	11·5	Crevices in calyx ; open calycine sinus.
Stem-end entry ..	18·3	Injuries to stem through faulty picking.
Insect punctures ..	11·7	Codling-moth and leaf-roller caterpillar injuries.
Russet	2·2	Frost or spray injury.
Lenticel entry ..	1·5	..

Certain fungi, such as *Sphaeropsis malorum* and *Diaporthe perniciosa*, have been recorded as causing a large percentage of wastage in consignments of New Zealand apples at the time of discharge in England. Mrs. Kidd(2) in 1928 recorded 44 per cent. infection with *S. malorum* on Jonathan, and 70 per cent. on Sturmer, also 40 per cent. infection with *D. perniciosa* on Cox's Orange. Miss Hellinger(3) in 1932 also reported a large percentage wastage due to *S. malorum*. These fungi have not been isolated during this investigation. The former is exceedingly rare in cool store, and the latter has not been collected in the Dominion. This suggests that these fungi either attack fruits on board ship *en route* to England, or in the market after arrival. These factors are significant, and call for further investigations into overseas shipments.

Thanks are due to officers of the Imperial Mycological Institute for identifying many and verifying most of the fungi listed; to the orchard instructors of the Horticulture Division, Department of Agriculture, for procuring specimens from the various cool stores; and to Mr. H. Drake for preparing the photographs.

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TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1933.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE position regarding Certificate-of-Record testing in 1933 must be classed as satisfactory, inasmuch as there was an increase in the number of certificates issued as compared with the calendar year 1932. Moreover, the past year was rich in individual performances, several outstanding yields having been authenticated. First-class Certificates-of-Record were issued to 507 cows in 1933, and of this number 461 cows qualified in the yearly-test division and the remaining 46 in the 305-day division. The support accorded the ten-months class continues to indicate that it is favoured by a very small percentage of our breeders, and that its popularity evidences no tendency to increase.

(1) C.O.R. YEARLY TEST DIVISION.

The 461 first-class certificates issued in the yearly division in 1933 represented an average production of 523·10 lb. butterfat per cow, an increase of 22·75 lb. over the 1932 average of 500·35, which was for 443 certificates.

FIRST-CLASS CERTIFICATES ISSUED.

Since the commencement of the C.O.R. system in 1912 8,545 cows have been granted first-class certificates. This number comprises

6,144 Jerseys, 1,679 Friesians, 435 Milking Shorthorns, 216 Ayrshires, 62 Red Polls, 2 Guernseys, and 7 Shorthorns. A numerical summary of yearly certificates issued during the past two years is provided by the following table :—

Table 1.

Breed.	1933.			1932.		
	Ordinary.	Repeat.	Total.	Ordinary.	Repeat.	Total.
Jersey	337	35	372	317	30	347
Friesian	54	15	69	56	15	71
Milking Shorthorn	11	1	12	16	..	16
Ayrshire	5	..	5	6	..	6
Shorthorn	1	..	1	..	..	..
Red Poll	..	2	2	3	..	3
Totals	408	53	461	398	45	443

Second-class Certificates issued.

Second-class certificates issued during the year under review numbered 37, as compared with 24 in 1932. Only two breeds were represented, 26 being Jerseys and 9 Friesians. The average production was 486·81 and 551·20 lb. fat respectively.

Third-class Certificates.

As explained in last year's review, a class has recently been instituted for cows which qualify for first or second-class C.O.R. in all respects save subsequent calving. It was also stated that, although the class was not intended to be retrospective, the Dairy Division was prepared to issue third-class certificates on past performances on receipt of an application from the owner, and the completion of the necessary statutory declaration as to milk weights, &c. Our records show that during the past year 76 third-class certificates were issued to Jerseys, and 10 to Friesians, one cow in each breed receiving certificates on two separate performances. The average for the Jerseys was 517·83 lb. fat from 9,154·7 lb. milk in 358 days and for the Friesians 685·86 lb. fat from 18,529·1 lb. milk in 365 days. Among the Jerseys was a 1,000 lb. record. Reshure Nova Supreme was credited with 15,440·4 lb. milk, containing 1007·42 lb. fat, in 365 days. It is unfortunate that she did not comply with the calving requirements for ordinary certificate.

Period between Calvings.

The average period between calving for commencement of test and calving subsequent to test for the 461 cows granted first-class certificates during the year was 403 days, being seven days more

FIG. 1. IVONDALE TINY HEATHER (P. J. PETERSEN, BRIXTON).

Highest C.O.R. Jersey, 1933. Four-year-old Class: 17,419·5 lb. milk, 1,061·3 lb. butterfat.

FIG. 2. GREENCROFT GOLDEN GRACE (J. BONES, KAIPAKI).

New leader junior two-year-old Jersey class: 14,678·4 lb. milk, 864·6 lb. butterfat.

than in 1932. The corresponding period for the second-class cows was 467 days, as compared with 469 days for the preceding year.

Jerseys.

Class Leaders.

One change of class-leadership took place among the Jerseys during the year. This occurred in the junior two-year-olds. In that class Mr. R. Waterhouse's Coniston Goldie, 742·71 lb. fat, gives way to Greencroft Golden Grace, bred and tested by Mr. J. Bones, Kaipaki. This heifer is credited with the particularly fine production of 864·61 lb. fat on a test commenced at 2 years 18 days of age. Another Jersey worthy of special mention is Mr. P. J. Petersen's Ivondale Tiny Heather. She is the tenth cow to gain a first-class C.O.R. on a production exceeding 1,000 lb. fat. On a test commenced at the age of 4 years 273 days Ivondale Tiny Heather yielded 17,419·5 lb. milk, containing 1,061·30 lb. fat. The Jersey class leaders are now as follows:—

Table 2.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old. Greencroft Golden Grace	J. Bones, Kaipaki ..	2 18	277·3	365	14,678·4	864·61
Senior Two-year-old. Ivondale Golden Rainbow	P. J. Petersen, Waitara	2 311	271·6	365	12,962·2	768·46
Three-year-old. Ivondale Silver Rainbow	P. J. Petersen, Waitara	3 327	309·7	365	15,073·4	950·63
Four-year-old. Woodlands Felicie	P. J. Petersen, Waitara	4 364	384·9	365	17,332·6	1,220·89
Mature. Holly Oak's Annie..	W. T. Williams, Pukehou	5 9	350·0	365	18,522·7	1,056·49

Jersey Class Averages.

Some 372 certificates were issued to Jerseys in the yearly division during the year, their average production of 513·09 lb., representing an increase of no less than 24·78 lb. fat over the preceding year's average of 488·31 fat. It will also be noted from Table 3 that each class showed a distinct increase in average yield. The class averages for 1933 and 1932 are given in the following table:—

Table 3.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1933.		lb.	lb.
Junior two-year-old ..	150	358	7,868·3	449·63
Senior two-year-old ..	44	356	8,931·5	500·61
Three-year-old	56	358	9,415·3	524·62
Four-year-old	43	354	10,613·7	602·26
Mature	79	358	10,487·8	583·83
	1932.			
Junior two-year-old ..	143	356	7,520·8	430·30
Senior two-year-old ..	33	346	7,916·9	442·51
Three-year-old	56	352	8,995·9	511·96
Four-year-old	41	358	10,188·6	573·61
Mature	74	354	9,880·4	555·68

The averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system are given in Table 4:—

Table 4.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	2,759	347	7,120·1	399·74
Senior two-year-old ..	740	345	7,839·9	442·36
Three-year-old	1,033	344	8,551·3	477·71
Four-year-old	710	347	9,149·9	509·73
Mature	1,695	346	9,481·3	521·40
All	6,937	346	8,194·7	456·88
Average test, 5·57.				

Jersey C.O.R. Bulls.

A bull is classed as a C.O.R. bull when he has four or more daughters with first-class certificates, each daughter being from a different dam. The names of 2,294 different sires now appear on our Jersey lists, and of this number 435 have qualified for the C.O.R. class. Champion butterfat bulls total twenty-two. This class is not connected with the Dairy Division, but was inaugurated by the New Zealand Jersey Cattle Breeders' Association, the qualifications being as follows: Each bull must have five or more daughters which under first-class C.O.R. conditions have produced 520 lb. butterfat when starting test up to three years of age, 580 lb. when starting between three and four years old, 640 lb. when starting between four and five years of age, or 700 lb. when five years old or over. As the class was originally constituted, it was necessary that each daughter should be from a different dam, but this qualification has recently been withdrawn. (The corresponding standards for cows in the 305-day test are 460 lb., 510 lb., 560 lb., and 620 lb. butterfat respectively.)

Friesians.

Class Leaders.

There is only one change to record in the Friesian class leaders. In the Junior four-year-olds Westmere Princess Pietertje, whose record of 939·78 lb. fat was made in 1918, yields her place to the Piri

FIG. 3. TOTARA VEEMAN LULU (PIRI LAND CO., AUCKLAND).

New leader junior four-year-old Friesian class: 22,364·2 lb. milk, 946·78 lb butterfat.

Land Co.'s Totara Veeman Lulu, who has gained a certificate for 946·78 lb. fat. The Friesian class leaders are now as follows:—

Table 5.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Monavale Queen Bess	T. H. Richards, Cardiff	2 16	242·1	365	20,501·1	740·50
Senior Two-year-old.						
Pareora Echo Blossom	T. Sheriff, Clandeboye	2 223	262·8	365	22,671·9	819·81
Junior Three-year-old.						
Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
Senior Three-year-old.						
Totara C.R. Buttercup	Piri Land Co., Auckland	3 247	336·7	365	25,885·3	989·10
Junior Four-year-old.						
Totara Veeman Lulu	Piri Land Co., Auckland	4 12	349·7	365	22,364·2	946·78
Senior Four-year-old.						
Totara C.R. Buttercup	Piri Land Co., Auckland	4 267	375·2	365	27,108·1	1,079·14
Mature.						
Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·5	1,145·24

Friesian Class Averages.

Certificates were issued to 69 Friesians in the yearly division in 1933, their average production being 589·01 lb. fat, an increase of 5·4 lb. over the preceding year's average of 583·61 lb. butterfat for 71 cows. The Friesian class averages for 1933 and 1932 are as follows :—

Table 6.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1933.		lb.	lb.
Junior two-year-old ..	25	361	13,721·3	490·50
Senior two-year-old ..	6	365	15,966·9	582·18
Junior three-year-old ..	2	365	18,415·5	679·73
Senior three-year-old ..	3	364	18,073·1	618·51
Junior four-year-old ..	7	356	18,133·7	674·97
Senior four-year-old ..	4	365	18,150·5	687·85
Mature	22	351	18,127·1	645·24
	1932.			
Junior two-year-old ..	30	360	13,390·8	495·31
Senior two-year-old ..	4	365	15,928·8	592·83
Junior three-year-old ..	3	364	11,932·1	463·79
Senior three-year-old ..	4	365	18,365·2	718·24
Junior four-year-old ..	7	362	17,287·2	611·12
Senior four-year-old ..	4	365	22,419·6	812·16
Mature	19	360	17,901·8	653·43

The averages, class by class, of all certificates issued to Friesian cows since the commencement of the C.O.R. system are given in the following table :—

Table 7.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year old ..	624	346	11,855·0	421·35
Senior two-year-old ..	257	347	12,716·1	452·19
Junior three-year-old ..	184	342	13,397·2	471·35
Senior three-year-old ..	186	337	14,008·2	502·20
Junior four-year-old ..	130	345	15,262·0	541·10
Senior four-year-old ..	128	347	16,142·4	565·49
Mature	565	342	16,024·9	563·15
All	2,074	344	13,905·7	491·89
Average test, 3·53.				

Friesian C.O.R. Bulls.

These now number 115, some 5 new names having been added during the year under review. A total of 607 sires are represented in the 1,695 Friesian cows (including the 305-day Division) certificated to the end of 1933.

Milking Shorthorns.

Class Leaders.

The outstanding performance of the year so far as the Milking Shorthorns are concerned was that of Ashley Bank Winsome, owned by Messrs. Peach Bros., of Sefton. Commencing test at the age of 4 years 298 days, this cow gained a certificate for 730·93 lb., and assumes the leadership of the senior four-year-olds in place of Messrs. Ranstead Bros. Matangi Ruth 2nd, 644·90 lb. fat. The Milking Shorthorn class leaders are now as appears in Table 8 on opposite page.

FIG. 4. ASHLEY BANK WINSOME (PEACH BROS., SEFTON).

New leader senior four-year-old Milking Shorthorn class: 17,687·7 lb. milk, 730·93 lb. butterfat.

Milking Shorthorn Class Averages.

Twelve Milking Shorthorn cows gained certificates in 1933, their average production being 502·79 lb. fat from 11,644·3 lb. milk in an average lactation of 351 days.

Table 8.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old.						
Matangi Quality 5th	Ranstead Bros., Matangi	2 204	260·9	365	11,752·8	542·66
Junior Three-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old.						
Matangi Rugh 2nd ..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old.						
Matangi Matilda 4th	Hon. Mrs. E. J. Blyth, Kohimarama	4 0	313·5	358	14,640·2	630·38
Senior Four-year-old.						
Ashley Bank Winsome	Peach Bros., Sefton	4 298	378·3	365	17,687·7	730·93
Mature.						
Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

The averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914 are given in the following table :—

Table 9.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old* ..	54	348	8,360·9	343·32
Senior two-year old ..	40	349	8,855·0	366·44
Junior three-year-old* ..	25	336	9,751·7	392·95
Senior three-year-old ..	30	343	10,772·2	447·39
Junior four-year-old ..	24	349	11,091·1	447·78
Senior four-year-old ..	32	342	11,609·4	461·21
Mature	272	341	11,769·8	471·56
Total	477	343	10,926·0	440·70
Average test, 4·03				

* No additions in 1933.

Milking Shorthorn C.O.R. Bulls.

No new names were added during the year to the list of Milking Shorthorn C.O.R. bulls, the total therefore remaining at fourteen. The 435 cows of this breed certificated to the end of 1933 were sired by 146 different bulls.

Ayrshire.

Five Ayrshire cows qualified for first-class C.O.R. in 1933, their average yield being 429·78 lb. from 10,454·3 lb. milk in 360 days. It should be mentioned that all five were in the two-year-old class. There were no changes in class leaders, the list remaining as follows :—

Table 10.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butterfat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Fair Maid of Greenbank	W. Moore, Homebush	2 27	243·2	365	12,281·3	673·56
Three-year-old.						
Maesgwyn Victoria ..	C. Morgan Williams, Kaiapoi	3 250	302·0	365	16,507·7	646·98
Four-year-old.						
Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature.						
Floss of Braeside ..	W. Moore, Homebush	7 287	350·0	365	20,305·5	832·72

Ayrshire Class Averages.

The averages, class by class, for all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912 are supplied by the following table :—

Table 11.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	68	346	9,005·0	373·54
Three-year-old*	38	347	10,043·0	414·16
Four-year-old*	27	346	11,378·0	459·52
Mature*	109	348	11,905·5	484·54
Total	242	347	10,739·2	439·51
Average test, 4·09.				

* No additions in 1933.

Ayrshire C.O.R. Bulls.

No further Ayrshire bulls qualified for the C.O.R. class during the year, the total to date remaining at eleven. Some 124 sires are represented in the 216 Ayrshire cows certificated to the close of 1933.

Red Polls.

Only two Red Polls qualified for certificate during the year, one in the four-year-old and the other in the mature class. The average

production was 485·89 lb. butterfat from 11,608·8 lb. milk in 365 days. Neither of these performances affected the class leadership, particulars being as follows :—

Table 12.

Name of Cow or Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butterfat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Wayward 6th B No. 1	G. S. Young, West Plains	2 188	259·3	365	11,228·0	511·42
Three-year-old.						
Dominion Gold Top	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old.						
Wayward 6th B No. 1	G. S. Young, West Plains	4 297	343·2	365	13,290·0	580·05
Mature.						
Waihou Pip ..	W. Jackson, Waihou	7 25	385·0	365	12,681·8	537·90

Red Poll Class Averages.

The averages, class by class, for all certificates issued to Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 are as follows :—

Table 13.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old*	39	345	7,616·4	338·15
Three-year-old*	14	348	8,004·4	350·45
Four-year-old	7	346	10,032·8	429·80
Mature	24	339	10,577·4	443·91
All	84	344	8,728·4	378·05
Average test, 4·33.				

* No additions in 1933.

Red Poll C.O.R. Bulls.

The sixty-three Red Poll cows (including one in the 305-day division) certificated to date represent twenty-five different sires, four of which have now qualified for the C.O.R. class. Certificates gained during the year did not alter the bull list for this breed, for the reason that two of the cows had already received certificates on earlier records and the third cow was sired by a bull already on the list.

(2) C.O.R. 305-DAY TEST DIVISION.

As previously stated only 46 first-class 305-day certificates were issued in 1933. Of these 39 went to Jerseys, 6 to Friesians, and one to a Red Poll. In addition a second-class C.O.R. was gained by a Jersey cow which failed by nine days to calve within the 395 days as required by the rules governing the system.

Jerseys.

Class Leaders.

Five classes are recognized in the Jersey breed and four of the previous class-leadership records were broken during the year the mature class alone remaining unchanged. The class leaders are now as follows :—

Table 14.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Erinview Empress ..	J. Murray, Woodville	2 70	257·5	305	9,163·2	523·99
Senior Two-year-old.						
Erinview Joan ..	J. Murray, Woodville	2 339	284·4	305	10,130·1	607·08
Three-year-old.						
Glendale Silver ..	A. Montgomerie, Kauwhata	3 319	318·9	305	11,352·7	631·42
Four-year-old.						
Montrose Leonie ..	V. J. Williams, Pukekohe	4 316	355·1	304	10,041·1	560·29
Mature.						
Perfection's Hopeful	J. A. Mitchell, Longburn	5 339	360·0	305	11,090·7	664·51

Jersey Class Averages.

The production averages, according to age class, of the 39 first-class certificates issued to cows of the Jersey breed during the year under review are given in Table 15. The average for all the cows was 450·96 lb. butterfat, and the average test 5·57 per cent.

Table 15.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1933.		lb.	lb.
Junior two-year-old ..	15	301	7,067·3	395·35
Senior two-year-old ..	4	305	8,720·2	499·97
Three-year-old	7	297	8,230·4	462·56
Four-year-old	4	279	8,565·2	478·10
Mature	9	301	9,204·5	500·79

Friesians.

Class Leaders.

One change took place in the Friesian 305-day division during the year, this being in the mature class. There were previously two blanks in the list no cows having been entered in either the junior three-year-old or junior four-year-old class. Paepaetahi Isobel being the only cow yet entered in the junior three-year-old automatically

assumes leadership of the class, but the junior four-year-olds still remain without a representative. The class leaders are now as follows :—

Table 16.

Name of Cows and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Waterloo Queen Helen Beets	R. S. Tuck, jun., Waharoa	2 4	250·9	305	11,585·50	425·48
Senior Two-year-old.						
Rosevale Beauty Posch Griselda	E. H. Watson, Windsor	2 216	272·1	305	12,273·50	468·50
Junior Three-year-old.						
Paepaetahi Isobel ..	A. F. Perkins, Taradale	3 20	289·0	292	10,920·00	461·67
Senior Three-year-old.						
Sealands Alcartra Fobes	H. G. A. Cameron, Weraroa	3 304	317·4	305	10,407·80	389·04
Junior Four-year-old.	..	..	..	..	..	..
Senior Four-year-old.						
Ellerlea Aaggie Segis Minto	C. H. Steadman, Pokapu	4 357	359·2	305	15,311·90	557·71
Mature.						
Ellerlea Egie Segis Minto	C. H. Steadman, Pokapu	6 345	360·0	305	16,303·10	650·85

Friesian Class Averages.

The average production of the 6 Friesians gaining certificates during the year was 438·31 lb. fat from 11,182·6 lb. milk in 293 days, the average test being 3·91 per cent. One cow was in the junior two-year-old class, two in the senior two-year-old class, one in the junior three-year-old class, and two in the mature class.

We desire to again record our appreciation for the courtesy and assistance of the secretaries of the various breeders' associations whose breeds participate in the testing.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 25th January to 22nd February, 1934, include the following of agricultural interest :—

No. 69357 : Drive for shearing-machines ; D. G. Sloan and J. S. Cowcher. No. 69496 : Hay-rake ; H. R. Saunders. No. 70382 : Animal medicine ; C. O. Saunders. No. 70767 : Blending butter ; J. O'Connell and H. H. Kerr. No. 71319 : Cream delivering ; H. G. Scetrine. No. 70513 : Wire-fencing tool ; F. A. Price. No. 70910 : Scouring of milking-machine ; J. F. Roberts. No. 71149 : Churn ; W. M. McCorkindale. No. 71348 : Harrow ; H. Thomas. No. 70126 : Castrating instrument ; A. Clark.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

PULLING OUT WOOL FIBRES AND ITS EFFECT ON HAIRINESS.

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IN experiments on the effects of shearing, new hairy fibres were frequently found where there was reason to believe that the original fibres had been pulled out of their follicles. It was also clear that where the animal was comparatively non-hairy the new fibres showed far less hairiness than in the case of hairy animals(1). These observations have been followed up with further experiments, and the results are given below.

Recent work on wool, as well as on many other animal characters of agricultural interest, has emphasized the importance of considering the underlying physiological potentialities upon which depends the maximum possible development of both structures and functions. Methods of measuring or recording these physiological potentialities are much to be desired, for such observations as we can make on the completed structure or on the functional activity of a part may give a very unfair indication of the underlying hereditary tendency. This is due to the complex interaction of genetic and environmental factors, which combine to produce great variations in the structure or in the function of a part. While we eagerly follow the many variations that appear in the yearly growth of wool, we may tend to forget that in a given animal many of these variations are due to different environmental causes acting on certain more or less constant tendencies. Thus one animal showing more hairiness than another may actually possess, if the two are compared under standard conditions, less, equal, or greater keratinizing ability. The purpose of the present work is to describe experiments on pulling out fibres by their roots (epilation), and to compare the regenerated fibres with those which they are succeeding. It is hoped that these observations on epilation will throw some light on the innate potentialities upon which the degree of hairiness depends, and perhaps, in addition, help in the elucidation of problems connected with fibre growth in general.

In higher vertebrates regeneration is most frequently met with in epidermal structures. Such examples as the growth of a new crop of feathers in birds plucked between moults, and the growth of a new coat in mammals after epilation are common knowledge. With reference to mammalian hair, Heusinger (1822) worked on the vibrissæ (or whiskers) of dogs and showed that even five days after the fibres were pulled out the new hair had become established. Vaillant (1861) on the guinea-pig found that the reappearance of hair at the skin level took place eight to twenty days after pulling, while the actual regeneration commenced before the fourth day. Giovannini (1890)(2) made some very detailed and complete studies on the regeneration of hair pulled from the human head. The results are somewhat surprising in that no regeneration occurred till forty-one days after epilation. General conclusions from observations on regeneration indicate that the new structure is nearly identical with the old and is formed in a manner apparently identical with the embryonic development. Wool, however,

must be looked upon not merely as a structure, but as the record of a continuous physiological process which is very much influenced by the interplay of genetic and environmental factors. These combine to produce such a large amount of variation along the length of the single fibre that it is quite obscure as to what part of the original record of growth will be most resembled by the record shown in the fibres following regeneration. The observations made in this paper refer very largely to curly-tip hairiness, which is often to be seen extending for a longer or shorter time after birth. Where the duration is longer there is very often a cessation or reduction of hairiness setting in about the time when the last of the birthcoat kemps complete their growth. This period, when fibres either cease or just maintain their growth, is referred to as the "crisis" or "crisis period," and occurs about the third month(3). How the extent and coarseness of the medullation in the regenerated wool compares with the pre-crisis hairiness is described below.

The Experiments.

Approximately one hundred samples of wool were pulled out of their follicles, the animals experimented with being crossbred lambs and hoggets of Romney type. Twenty such samples were pulled in the lamb stage during midsummer, while the remaining samples were pulled in midwinter. At least three samples were pulled from each animal, but sometimes five samples were taken. Regions sampled were the britch, side, back, foreleg, and shoulder, while the areas sampled were circular and never more than $\frac{3}{4}$ in. in diameter.

(*a*) *Examination of Animals showing a Considerably Hairy Tip in the Lamb's Coat.*

In each case britch, back, and foreleg were pulled in midsummer. Hairy-tipped fibres replaced the original, and the new growth was either as coarsely medullated as or more coarsely medullated than the lamb's coat. Where the hairiness in the fleece of the lamb ceased or was reduced well before the crisis-level, the hairiness following pulling was not well sustained, but following a fleece wherein medulla ceased or was reduced at or near the crisis-level the hairiness following upon pulling generally lasted some three or four months. (Fig. 1.) Thus after epilation the medullation is also comparable in extent with that in the lamb's coat. The medulla-producing effect of pulling is a definitely local one. Numerous samples were examined from regions adjacent to pulled staples, but these were quite unaffected.

In midwinter other fibres were pulled on the same animals in the hogget stage. The hairiness of the new fibres exceeded, equalled, or was less than that of the lamb's fleece. In cases where there was a reduction in the amount of medulla produced by pulling, this reduction might be seen at one part of the body and not at another. In certain lambs, which were nearly equally hairy at back and side, there was a great difference in the amount of medulla produced at these points following shearing. After pulling out fibres on these animals it was found that in the regenerated wool the back was either much reduced relative to the side or both regions had been reduced relative to the lamb's coat. Hence there is some reason to believe that the reduced hairiness following pulling is due to an improvement in the keratinizing power. On the

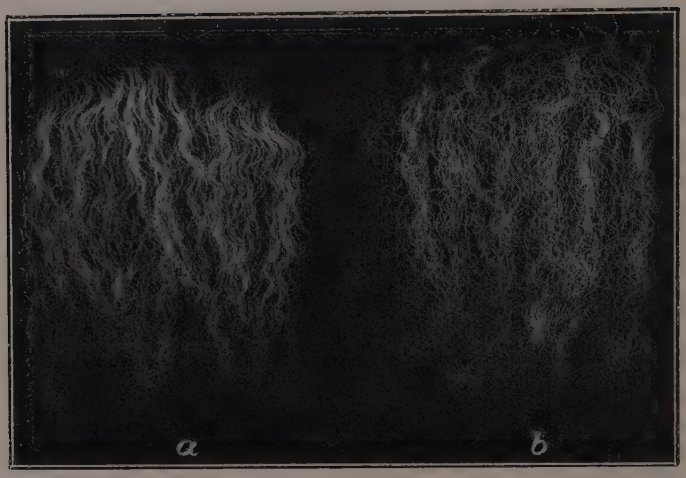

FIG. 1. PHOTOGRAPH OF WOOL SPECIMENS IN BENZOL.

(*a*) The coat of a lamb showing reduction in hairiness about the crisis-level.

(*b*) After pulling the wool in mid-winter from the same position as (*a*). Hairiness is maintained for several months, being closely comparable with that in the lamb's coat.

FIG. 2. PHOTOGRAPH OF WOOL SPECIMENS IN BENZOL.

(*a*) The coat of a lamb which grew very badly. Thin medulla is shown for a short time after birth while at the base of the sample a very little medulla has come in again.

(*b*) After pulling the wool in mid-winter from the same position as (*a*). Hairiness is well sustained in the regenerated growth.

other hand, a suppressing effect due to winter conditions must be considered, and it remains to be seen from the results of pulling in summer, during the two-tooth stage, whether there is evidence of such an effect.

(*b*) *Examination of Animals that showed Very Little Hairiness in the Lamb's Coat, but nevertheless became Hairy about the Fourth Month or Following Shearing.*

In such cases, as a result of pulling, the regenerated fibres were distinctly hairy, while this hairiness generally lasted for several months. (Fig. 2 (*b*).) Such examples came into the following two classes. The absence of hairiness in the coat of the lamb was in some cases due to infilling or collapse of the medulla(7), while in a further instance (Fig. 2 (*a*)) the condition closely corresponded to cases already described by Dry(3). In certain of his lambs, which had grown badly, medulla appeared in the usual way immediately after birth, but was of very short duration, ceasing well before the crisis-level and was not revived until the third or fourth month.

(*c*) *Examination of Animals showing Little or No Hairiness in the Lamb's Coat, this being the only Hairiness to appear whether shorn or unshorn.*

In most cases a very thin medulla appeared after pulling, but was often much delayed. Such hairiness equals in coarseness those traces in the tips of the fleece and lasts for but a short time. Quite often the hairiness in the regenerated fibres is noticeably coarser and more extensive than anything in the lamb's coat, suggesting that with regeneration the latent tendencies to produce medulla are expressed vigorously.

Those animals which showed an increase in the amount of hairiness following pulling as compared with the lamb's coat (Fig. 3) were subjected to a more detailed examination. The condition as to the fibre-type array(4) at back and side was investigated and a brief summary of observations is given in the following table :—

Number.	The Fibre-type Array in the Coat of the Lamb.	Hairiness in Regenerated Wool, following pulling.
720 (side)	Fine big-ended sickle-fibres; very gradual rise in later sickles with fine medullation in early curly-tip fibres. (*Ravine array*)	As examined in benzol with naked eye the samples are slightly more hairy after pulling.
624 (back)	Persistent finely medullated sickles; fine checked sickles; fine checked early curly-tip fibres; coarser but non-medullated later curly-tip fibres. (*Valley array*)	More hairy after pulling than in the lamb's coat. Finer medulla than at the side.
624 (side)	Shed sickles present (fig. 3 (*a*)). Persistent medullated sickles; fine checked sickles; fine checked curly-tip fibres with a rise to coarser curly-tip fibres showing a little medullation. (*Valley array*)	More hairy after pulling than in the lamb's coat 3 (*b*).
853 (side)	Shed sickles present; persistent medullated sickles; fine checked sickles; fine checked curly-tip fibres with a rise to coarser curly-tip fibres of which an odd one or two are medullated. (*Valley array*)	After pulling there is a distinct band of hairiness which lasts for about one month.
669 (side)	Number of persistent medullated sickle-fibres = 10. Number of sickle-fibres with medullated sickle portion = 25. Number of non-medullated sickle-fibres = 35. Number of curly-tip fibres and later fibres = 580. The fibre-type array is a broad *ravine* with no rise to hairiness in the curly-tip fibres. Total number of medullated fibres = 35. Total number of sickle fibres = 70.	A large number of the regenerated fibres following the pulling of this staple were counted as follows :— Number of more coarsely medullated fibres = 7. Number of fibres which can be selected as medullated by naked eye examination in benzol = 43. Number of curly-tip and later fibres = 420. Then expressed per 580 fibres the total number of medullated fibres = 60.

The conditions obtaining in the above samples of wool are (*a*) the existence of a fairly powerful prenatal check ; and (*b*) the drive towards hairiness is fairly vigorous, but extends only weakly into the curly-tip portion of the array. The case of No. 669 (side) is noteworthy where it appears possible that it is the sickle portion of the array that has become medullated as a result of pulling. One may consider that evidence has been brought forward that as a result of the prenatal check the appearance is given of a lesser inherent drive towards hairiness than is really the case, and that the checked fibre may be looked upon as a potential source of hairiness.

It is questionable whether it is the act of pulling that should be considered as the stimulus to the production of medulla. Alternatively, one might consider the new hairiness as dependent upon the nature of the regeneration process, and not on the external mechanical effect

FIG. 3. PHOTOGRAPH OF WOOL SPECIMENS IN BENZOL.

(*a*) The coat of a lamb wherein there has been a powerful prenatal check. The conspicuous hairy fibres are shed sickle fibres.

(*b*) After pulling the wool in mid-winter from the same position as (*a*). The regenerated growth is more evenly and extensively medullated than in the lamb's coat.

of pulling. This view is also supported by the similarity in duration of the lamb's coat hairiness and the regenerated hairiness, both of which are most likely directed by factors for medulla production which become expressed as a result of the new start that the fibre is making. It is hoped to throw further light on this matter by epilating with injections of thallium acetate, and experiments with this have been performed.

In the sheep regeneration following pulling commences almost immediately from the old papilla, the growth of the inner root sheath and the new pointed fibre tip being established by the fifth day, while the foremost fibres reach the skin-level about the fourteenth day. The study of successional fibres of birthcoat kemps in the Romney indicates that the new fibres are variable, being either coarsely hairy, only slightly hairy or even non-hairy(3). Furthermore, there is abundant

evidence from the work of Duerden(5) and Roberts(6) that following shed kemps persistent wool fibres may arise. Various histological preparations of skin were made, and from an examination of these it appears likely that the difference between the new fibres after pulling and after normal shedding may be associated with the greater changes (or degree of atrophy) that occur in the bulb of the follicle following normal shedding as compared with the happenings following pulling where the old papilla is directly the source of the new fibre.

The New Fibre Tips after Pulling.

In a sample of the regenerated wool three types of fibre tip are met with. By far the most common are the tapering pointed tips characteristic of newly arising fibres. Such pointed tips are formed when the inner root sheath has been dislodged. With the formation of new root sheaths new tapering fibre tips appear. But a variable percentage of blunt tips is to be found. Some of these are merely fibres that have been broken off more or less at the level of the skin, while others have been broken at some level between the tip of the papilla and the point at which the fibre frees itself from contact with the inner root-sheath. These latter tips are frequently club-like, and they present a smoky appearance due to air inclusions among the cortical cells (Fig. 5), while almost invariably there is a further smoky swelling a little distance behind the distal end (Figs. 4 (*a*) and (*b*)). These broken fibres, however, behave very differently from the completely pulled fibres and either remain non-medullated or show just a trace of medulla. Very similar fibres are commonly produced by tugging the wool.

Many of the newly arising fibres possess the whip-lash tip that has been described by Duerden and Wildman in the embryo (Fig. 4 (*b*)). Such a tip is formed by the bending-over of the slender point while it is being thrust through the mouth of the follicle by growth from below. A very small percentage of the new pointed fibres show a smoky swelling some little distance from the distal tip, the fibres being normal in other respects. Following pulling it is quite common to encounter sickle-like ends which correspond closely to that form upon which the sickle-fibre type is based. But it is worthy of note that none of these sickle tips show the neck thinning which is believed to be the expression of a definite prenatal check(3).

The Effect of tugging or mishandling Wool, without pulling it completely from its Roots.

Wool fibres broken off at the surface of the skin during epilation frequently became smoky(7) shortly afterwards, while fibres on areas adjacent to the pulled regions did not possess this feature. Staples of wool which were purposely tugged showed, in some of the fibres, this same accumulation of air spaces within the fibre cortex, the spaces being elongated in form and lying parallel to the fibre length (Fig. 4 (*c*)). Such smokiness has been found in the fleece extending as a very distinct band across the length of a staple, while neighbouring staples were free from smokiness—a fact strongly suggesting that the wool under consideration had been mishandled (Fig. 6). Simple trials of the tensile strength of smoky fibres indicates that they are greatly

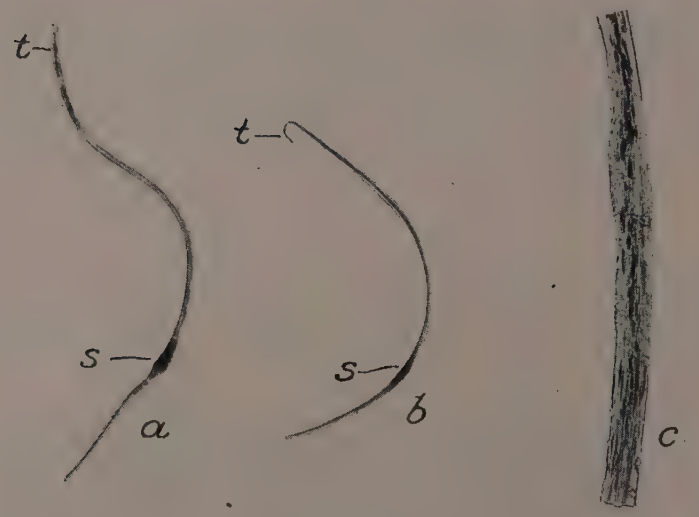

FIG. 4.

(*a*) A blunt-tipped fibre after pulling. There is some distinct smokiness in the tip at *t*, while there is a conspicuous "smoky" swelling at *s*.

(*b*) A pointed-tipped fibre after pulling. A fine whip-lash tip is shown at *t*, while there is a "smoky" swelling at *s*.

(*c*) Photomicrograph of a more obvious case of "smoky" wool such as is shown in Fig. 6. The elongated air spaces within the cortex are conspicuous. ×200.

FIG. 5.

(*a*) A fibre with a new pointed tip, but a "smoky" swelling shortly below the tip.

(*b*), (*c*), (*d*), and (*e*) Various club-ended fibres, the club being "smoky." In (*d*) individual cortical cells can be seen projecting from the distal extremity. ×100.

weakened. In more extreme cases of smokiness even the gentle stresses which are sufficient to straighten out the crimpiness may cause the fibres to snap at the smoky region. It is true that sheep are very often grasped by the wool, considerable tension being placed upon the fibres. Such a practice should be avoided both on account of the causing of additional hairiness by pulling out some of the fibres and of the production of weak smoky regions. On other occasions these defects may be multiplied when the wool becomes entangled in fences, trees, or hedges.

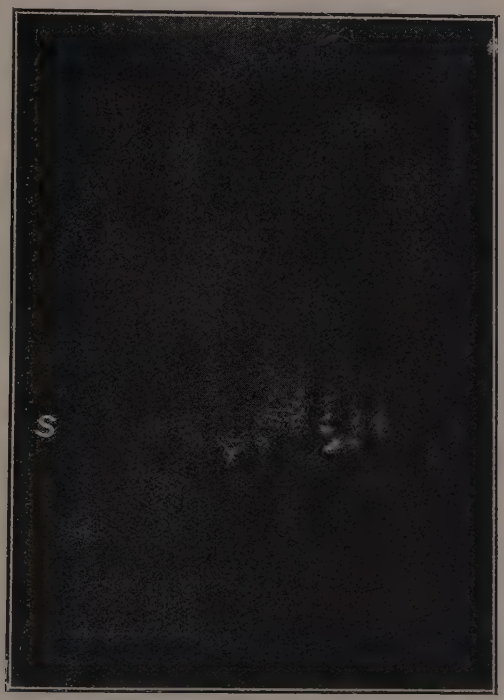

FIG. 6. PHOTOGRAPH OF WOOL SPECIMEN IN BENZOL.

Except at the tips of the staple, this sample is entirely free from hairiness. At *s* there is a conspicuous band of "smoky" wool, but such smokiness is absent from neighbouring staples, suggesting that the sample under consideration had been mishandled.

SUMMARY.

1. Preliminary experiments on the pulling-out of wool fibres are described. Regeneration of new fibres from the old papillæ begins almost immediately, the fibres beginning to penetrate through the skin at two weeks.

2. Where the hairiness of the lamb's coat extends for two to three months the hairiness of the regenerated fibres has a comparable duration and is generally as coarse as or coarser than the lamb's coat hairiness. Several cases have been found, especially in hogget fleeces, where the medulla was noticeably reduced following pulling.

3. In the case of animals possessing little or no hairy tip in the lamb's coat, the hairiness of the regenerated fibres is equal in coarseness

or coarser, and usually of little duration. It is considered that freedom from hairiness after epilation gives a good indication of vigorous keratinizing power.

4. By pulling out wool fibres a good estimation of the drive towards hairiness may be obtained from the amount of medulla in the regenerated fibres. This may be useful in normal cases where the lamb's coat is not known; in cases where it is desired to follow the improvement in the keratinizing power; in cases where the lamb has grown badly with an apparent reduction in the vigour of medulla-production; in cases where there has been infilling of the medulla; in cases where the strength of the prenatal check has caused an apparent reduction in the hairiness of the samples.

5. Wool that is mishandled by tugging it may become "smoky"—that is, show air spaces in the cortex. In extreme cases of smokiness the fibres are very considerably weakened.

The writer wishes to acknowledge a grant from the Department of Scientific and Industrial Research in aid of wool investigation.

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THE CONTROL OF STINKING SMUT OF WHEAT.

EXPERIMENTS ON SEED TREATMENT WITH VARIOUS DUSTS.

J. C. Neill, Field Mycologist, Mycological Laboratory, Plant Research Station, Palmerston North.

The object of the experiments described herein was to compare the relative efficiency of the dusts at present available in New Zealand for the treatment of seed wheat.

Two samples of wheat were used, one being from a line of Solid Straw Tuscan carrying a heavy natural infection of stinking smut, the other from a smut-free line of Jumbuck artificially inoculated at the rate of 1 to 1,000 parts by weight with spores of the smut.

Portions of the samples were dusted at monthly intervals from March until August, the Solid Straw Tuscan at the rate of 4 oz. of the dust per bushel of seed, the Jumbuck at 2 oz. per bushel. The treated seeds were all sown on the 14th and 15th of August in four rod rows, 100 seeds to the row, together with twelve rows of untreated seed from the same samples.

The plants were pulled and examined when ready to harvest in January, the number of headed plants and of those having one or more smutted heads being recorded. The results are given in Table 1.

Table 1.

Date treated (1933)	Mar. 15.		Apl. 12.		May 15.		June 15.		July 14.		Aug. 12.		Mean.	
Treatment.	Plants.*	Smutted.	Plants.*	Smutted.	Plants.*	Smutted.	Plants.*	Smutted.	Plants.*	Smutted.	Plants.*	Smutted.	Plants.	Smutted.
SOLID STRAW TUSCAN.		%		%		%		%		%		%		%
Control (untreated)	..	..	..	..	..	..	..	..	..	..	..	..	78	56
Copper carbonate†—														
No. 1 (18 per cent. Cu.)	..	..	..	..	..	..	..	..	..	..	88	0·3	88	0·3
No. 2 (20 per cent. Cu.)	76	1·0	75	0·3	82	1·5	78	5·4	90	1·4	77	0	81	1·6
No. 3 (51 per cent. Cu.)	81	0·3	82	0·3	79	1·0	72	1·4	89	3·1	85	0	81	1·0
Copper Oxychloride (Smutol 53 per cent. Cu.)	78	0·3	85	0	75	0·3	71	0	87	0	79	0·3	79	0·1
Agrosan G (1·5 per cent. Hg)	..	..	81	9·6	78	3·2	78	1·3	83	1·8	83	0·6	81	3·3
Ceresan	..	..	86	0	75	0·3	..	..	..	..	..	..	80	0·1
Ceresan New (1·3 per cent. Hg)	..	..	..	..	..	..	72	0	83	0	79	0	78	0
Semesan (2·2 per cent. Hg)	82	2·0	78	3·5	80	1·5	76	0·6	86	2·0	90	7·2	82	2·8
JUMBUCK.														
Control (untreated)	..	..	..	..	..	..	..	..	..	..	..	..	75	25
Copper carbonate—														
No. 1	..	..	..	..	..	..	..	..	..	..	85	0	85	0
No. 2	71	0	74	0	75	0·3	70	0·3	82	0	80	0	75	0·1
No. 3	75	0	74	0	76	0	73	0	83	0	83	0	78	0
Copper oxychloride (Smutol)	80	0	78	0	74	0	74	0	85	0	76	0	78	0
Agrosan G	..	..	73	0	78	0·3	76	0·3	92	0	81	0	80	0·1
Ceresan	74	0	73	0	75	0	79	0	..	..	..	..	75	0
Ceresan New	..	..	..	..	..	..	81	0	90	0	72	0	81	0
Semesan	86	0	76	0	73	0	79	0	88	0	82	0·3	81	0·1

* Per hundred seeds sown. † Analyses by Dominion Analyst, Wellington.

SUMMARY OF RESULTS.

With the heavy natural infection of the sample of Solid Straw Tuscan complete control of the smut was obtained only with Ceresan New. Ceresan was nearly as effective, but the other organic mercury dusts—Agrosan G, and Semesan—were much less so. No correlation was apparent between mercury content and fungicidal value with these compounds, though the sample of Semesan had been in the laboratory for three years and may have deteriorated. Of the copper compounds, excluding the insufficiently tested No. 1 copper carbonate, Smutol (copper oxychloride) gave the best results, followed closely by the copper carbonates in the order of their relative copper content.

Infection of the Jumbuck wheat was lighter than that of the Tuscan, though still heavy enough to yield 25 per cent. of smutted plants in the sowings of untreated seed. With this wheat all the dusts controlled the smut well, only Agrosan G. Semesan, and the low-copper-content carbonate failing to eliminate it completely.

There were no significant differences in the degree of smut control shown by treatments carried out at monthly intervals between harvest and sowing.

The number of plants harvested per hundred seeds sown varied very little between any of the treatments, though in general treated seeds showed slightly better results than the untreated controls.

THE CHEMISTRY OF WEED-KILLERS.

*(Continued.)**

B. C. Aston, Chief Chemist, and J. A. Bruce, Inspector of Fertilizers, Department of Agriculture.

During the last few months, especially those of summer, continued attention has been devoted by the junior author and his staff to the trial of various possible chemical compounds as specific killers of ragwort. The substances selected included both proprietary weed-killers obtained under trade names and substances sold under their correct chemical names.

The need for this work has been repeatedly impressed upon the writers owing to the disasters, fortunately confined to single individuals, which have been from time to time reported in the press. These indicate that the accidents mentioned in the April, 1933, *Journal* are by no means the last which may be expected to occur when carelessness is allowed to creep in, in dealing with this powerful inflamant and explosive. For instance, quite recently a farmer's clothes burst into flames as a result of carrying a small amount of sodium chlorate loose in his pocket. A motor-car was burnt owing to the hood of the car being used to hold sodium chlorate concurrent with the effect of the hot sun and a certain amount of friction. The worst accident, however, was that which caused the death of a worker, a farm hand, who had neglected to change his clothes saturated with chlorate spray and who, striking a match to look at his sleeping child, in an instant became, according to his wife's account, a " pillar of flame."

Investigational Work in Progress.

During the year, therefore, some eighty tests have been made with thirty-six different substances on a number of different areas allowing differences in climate, soil, and situation to be the subject of experiment. Ragwort plants have also been grown in a garden in the seedling state row by row thereby rendering it possible to obtain more definite figures representing the kill by various treatments. Most of the experiments had necessarily to be conducted in or near Wellington City, but the assistance of Mr. C. R. Taylor, Analyst's Assistant, stationed at Rotorua, was invoked, and, as a result, interesting data on that peculiar type of country known to the majority of people as " pumice lands " was obtained. Unfortunately, the spring and summer season has proved exceptional in the rainfall in Wellington, and at the very time when it was hoped to attack the ragwort at what is probably its most vulnerable period, unseasonable and very heavy rains may have so altered the results as to render them uncertain as a guide to what may be expected in normal seasons.

The trial of ammonium thiocyanate (sulphocyanide) has been continued, and a solution of 5-per-cent. strength found to give good results at Rotorua, a complete kill being obtained, although it took some months to do so. Crude sodium thiocyanate liquor in 5-per-cent.

* Previous articles may be consulted in this Journal for February, April, and July, 1933.

solution on ragwort half grown and in flower showed great promise, and a complete kill is expected. It is expected that the 3-per-cent. solution, if properly applied, would give satisfactory results. The crude sodium thiocyanate in the form of fused cakes blackened plants very rapidly, but the stems maintained their vitality for some weeks. Wellington experience confirms this Rotorua experiment, as it was found to take many weeks to effect a complete kill after spraying. A point in favour of the use of thiocyanate is that the pasture, both clovers and grasses, is notably stimulated after the poisonous action of the dressing has passed away, the good effect being due probably to the ammoniacal nitrogen contained in the thiocyanate. Other interesting results obtained were that, in the comparison of sodium chlorate with ammonium thiocyanate, whereas the chlorate apparently benefited by the wet weather which immediately followed spraying, the killing effect of the thiocyanate was depressed by the rain. Seeing that sodium chlorate is so highly efficient as a weedicide and especially as a killer of ragwort, it was thought that other highly potent oxidizing agents might be similarly efficacious as weedicides and some of these oxidizers have given very interesting results.

Permanganate of potash proved to be a complete failure in spite of the large amount of available oxygen it contains. Bleaching-powder (calcium hypochlorite) both in a 5-per-cent. solution and applied dry was fairly successful in killing ragwort and merits further experimental work. Sodium hypochlorite in 10 per cent. solution gave better results than any other substance at Rotorua. As an academic result it is interesting to record that in the study of the effects of oxidizing salts sodium peroxide applied dry was easily the most effective substance used to kill ragwort in all the experiments, but this compound is at present far too costly to use and, of course, is highly dangerous to handle as a commercial product.

Scope for Future Investigation.

In following this idea of research for an oxidizing salt which has a similar effect as a ragwort-killer to sodium chlorate without the danger of that compound, one would naturally consider the chromates. Those readily accessible on the market are the chromates and bichromates of potash and sodium. Experiments with these compounds indicate that they may prove efficient as exterminators of ragwort. While not having the violent inflammatory possibilities of sodium chlorate when mixed with organic materials, they have a poisonous local effect on human beings when constantly breathed as a fine dust, attacking especially the surface of the body where the skin is broken, producing ulcers which heal with great difficulty and corroding mucous surfaces. The occurrence of cases of acute poisoning are, however, rare. The use of the chromates in the arts and manufactures is so well known that there will probably be little difficulty in effecting a technique which will minimize their poisonous nature to human beings and any possible ill-effect to stock. Experiments at Wellington showed that under the conditions prevailing at the end of February, 1934, 100 per cent. kill of ragwort was obtained by spraying with 5 per cent. solution of sodium bichromate in water at the rate of under 400 gallons to the acre; half this strength being nearly as effective.

(To be continued.)

EFFECT OF EXCESS OF DISINFECTANT DUSTS ON THE FIELD GERMINATION OF SEED WHEAT.

J. C. NEILL, Field Mycologist, Plant Research Station, Palmerston North.

CERTAIN types of continuous-action seed-dusting machines at times accumulate excess dust at the delivery end with the result that the quantity carried by the seed on discharge is apt to increase suddenly to much above the normal. The fault may not be detected and remedied until one or more bags are filled with this overdusted seed. It is of interest therefore to know whether the germination of this seed would be adversely affected when sown in the field.

In the following experiment on the point, samples from a line of Jumbuck seed wheat were shaken in a closed container with some of the commoner seed dusts at 1 part by weight of the dust to 12 parts by weight of the seed—that is, a proportion of dust forty times greater than the normal 2 oz. to the bushel. The dusted seed was sown by hand in October in two blocks, one block having no manure, and the other superphosphate at the rate of 3 cwt. per acre distributed in the open drills with the seed.

Four hundred seeds were sown for each treatment, and the germination counted three weeks after emergence. The results are given in tabular form below :—

Treatment.	Percentage Germination.	
	No Manure.	3 cwt. Super.
Control (no treatment)	74	41
Ceresan New	8	46
Ceresan	2	0
Agrosan G.	69	55
Copper carbonate 20 per cent. copper ..	72	44
Copper carbonate 51 per cent. copper ..	67	56

SUMMARY OF RESULTS.

Excess copper carbonate, either high or low grade, and Agrosan G, had little or no effect on the field germination of wheat, where sown with or without superphosphate. Ceresan in excess practically inhibited germination under the same conditions, while Ceresan New caused severe injury without manure, but gave slightly better germination than the untreated seed when sown with superphosphate.

The *per capita* consumption of butter in the United Kingdom in 1932 was approximately 21·8 lb., compared with 20·9 lb. in 1931, and an average of 15·6 lb. in the four years 1924 to 1927.—*Empire Marketing Board.*

AREAS OF GRASSLAND TOP-DRESSED, 1932-33.

THE following table, supplied by the Census and Statistics Office, shows the area of grassland in New Zealand top-dressed once or more with artificial fertilizers only, artificial fertilizers and lime, and lime only during the twelve months ended 31st January, 1933 :—

Land District.	With Artificial Fertilizers only.	With Lime only.	With both Artificial Fertilizers and Lime.	Total Area Top-dressed.
	Acres.	Acres.	Acres.	Acres.
North Auckland ..	330,211	12,270	90,216	432,697
Auckland	593,731	23,020	299,325	916,076
Gisborne	28,957	1,008	2,108	32,073
Hawke's Bay	89,838	4,579	8,194	102,611
Taranaki	290,345	7,793	49,112	347,250
Wellington	250,418	12,415	49,037	311,870
Nelson	18,270	2,017	7,027	27,314
Marlborough	12,395	569	1,942	14,906
Westland	4,080	2,333	3,382	9,795
Canterbury	39,495	12,101	16,392	67,988
Otago	32,305	7,345	10,528	50,178
Southland	50,990	17,502	56,864	125,356
Totals ..	1,741,035	102,952	594,127	2,438,114

In the two previous years the cognate figures for the Dominion were :—

—	Season 1930-31.	Season 1931-32.
	Acres.	Acres.
Top-dressed with fertilizers	2,432,438	2,067,672
Top-dressed with lime ..	438,878	386,649

RETIREMENT OF MR. J. W. DEEM, DIRECTOR OF FIELDS DIVISION.

BECAUSE of the completion of the statutory forty years of service Mr. J. W. Deem has retired on superannuation from the position of Director of the Fields Division. Mr. Deem, who commenced his service at Awatere over forty years ago, later held positions as an officer of the Department at Waimate, Fairlie, New Plymouth, and Hawera before he became Fields Supervisor at Wanganui in 1913. He became Supervisor of Subsidized Demonstration Farms in 1919, and was for a period Manager of Moumahaki State Farm. In 1928 he was appointed Fields Superintendent at Palmerston North, and in 1929 he succeeded Mr. A. H. Cockayne as Director of the Fields Division.

At a large representative gathering at Palmerston North Dr. C. J. Reakes, Director-General of Agriculture, on behalf of officers of the Department, presented Mr. Deem with a gold watch and handed him a handsome tea-service for Mrs. Deem. In making the presentation, Dr. Reakes referred at length to the many good qualities and the high value, recognized for many years, of Mr. Deem as an officer of the Department. Mr. A. H. Cockayne, Assistant Director-General, in supporting the tributes paid by Dr. Reakes, *inter alia*, mentioned the vast store of knowledge of farming possessed by Mr. Deem. A message from the Minister of Agriculture expressing appreciation of Mr. Deem's valuable and faithful services to the Department was also received.

SEASONAL NOTES.

THE FARM.

The Role of Top-dressing.

In farming, and particularly in dairying, during the current difficult times, a consideration of prime moment relative to any practice is its bearing on the cost of production. At times, farmers, if they can be judged by their actions, are not guided in their decisions about top-dressing by its prospective bearing on their farming costs. In this connection it is of moment that an increase of say 20 per cent. in production due to the use of fertilizer on grassland usually represents much more than an increase of 20 per cent. in net returns. This is because the overhead charges for land, equipment, and labour would be substantially the same for the lower as for the higher production, and hence the main items that should be set against the value of the increased production due to top-dressing are the cost of the manure and the interest and depreciation on the extra stock utilized. The position may be illustrated by consideration of a sheep farm, the carrying-capacity of which is increased by top-dressing from 1,500 to 2,000 ewes. In such a case the top-dressing may rightly be credited with the whole of the returns for the extra 500 ewes less only the cost of the fertilizer and the cost of interest and depreciation on the extra stock. Alternatively the relationship of top-dressing to cost of production in such a case may be gauged from the fact that top-dressing would result in heavy fixed charges—such as annual cost of land, equipment, and labour—being spread over the returns of not 1,500, but 2,000 sheep, representing a fall of 25 per cent. in these fixed charges, provided the value of the production of stock units remained constant. If the value of top-dressing were estimated carefully in this way as often as it should be, then there would be a substantial increase in the amount of fertilizer used in top-dressing.

While in some instances, in view of current produce prices, top-dressing may not affect the returns enough to turn an unprofitable farming proposition into a profitable one, it may be expected, as a rule, to make unprofitable farms less unprofitable.

Judgment in Top-dressing important.

Two qualifications attach to the preceding statements relative to the value of top-dressing. In the first place, the statements presuppose judicious expenditure on top-dressing. At times expenditure on top-dressing is far from judicious, and so it seems worth stating that top-dressing practice should be based on evidence provided as a result of local field experience. Too often farmers are swayed in respect to their manure purchases by tradition, by semi-scientific or by pseudo-scientific jargon, or by accounts of varying accuracy about experience in other districts in which the conditions may or may not be essentially different. As a result, outlay is dissipated on top-dressing material from which little or no benefit seems to be obtained, whereas often equal outlay could be made on other material which would give eminently attractive results. The uncertain value of guidance taken from experience in other districts is strikingly exemplified in the case of the use of both lime and potash. In certain districts definite visible benefit follows the use of one or both these substances on grassland. Though at times the economic value of this beneficial effect may not have been

measured accurately, the effect is striking enough to justify the use of the substances either freely or fairly extensively in a trial way. On the other hand, in certain other districts, sometimes not far distant from the former ones, visible benefit results from neither lime nor potash applied to pastures, and recommendations to use lime or potash in the latter districts cannot be justified because of the experience in the former districts. Yet, strange as it may seem, top-dressing is at times based on such recommendations.

The influence of tradition and of miscellaneous jargon commonly replaces the influence of field evidence as the basis of liming. For instance, it is to some extent a tradition that liming will improve stock in respect to bone-development. Before attaching much weight to this as a basis of specific top-dressing action, it is well to establish whether stock show any deficiency in bone-development, and, if so, to inquire further whether phosphatic manures which normally enrich the pastures in lime and phosphoric acid—both of which are essential for bone-development—could not be advantageously employed to remedy the weakness. In a somewhat similar way the traditional use of liming as a means of reducing the incidence of stock disease should be considered. If this is done it will often be found that no causal connection between liming and disease has been established in respect to some districts in which liming has been advocated largely as a means of coping with stock diseases. However, there are occasions in which reduction in disease has been associated with liming. The need is to restrict suitably the application of conclusions deduced from such occasions. Elementary as the above reasoning about the basis of top-dressing may seem, it is so often violated that farmers might well ask themselves whether their top-dressing is founded on comparable field experience or on one of the other bases such as tradition, &c.

Top-dressing not always advisable.

In the second place, general statements relative to the value of top-dressing always should be restricted by the qualification that there are grassland areas for which top-dressing is not recommended. This is likely to be true, for instance, of land of relatively low carrying-capacity, and especially is this so when low prices prevail. In illustration of this, improved price of wool and lambs may make top-dressing profitable on sheep country where it previously would have been unprofitable. However, the areas on which wet stock are carried and on which top-dressing is not advisable are exceptional, and a farmer should satisfy himself that his is one of the exceptional areas before he decides to forgo the substantial assistance usually obtainable from appropriate top-dressing.

Phosphatic Top-dressing.

The widespread value of phosphatic top-dressing has been definitely established. In general, the supply of available phosphate is the weakest link in the chain of food requirements of pastures, though in a few cases the weakness in respect to lime rivals, if it does not equal, that in respect of phosphates, and in other cases, seemingly fewer still, this may be true of the weakness in respect to potash. Hence, in general, the basic need is phosphatic top-dressing. Of the phosphatic manures superphosphate is most largely used. The popularity of superphosphate is supported by field observations; it gives superior results under low-rainfall conditions, and where the rainfall ranges from moderate to high it generally, at least, equals, if it does not excel, other phosphatic manures; of the phosphatic manures, it most quickly brings about increased growth; it usually continues to stimulate growth

for a longer period than many realize—the continuation of substantial benefit from superphosphate after twelve months has been noted, and it does not cause any permanent increase in the sourness of the soil.

On certain farms splendid results have been obtained from the use of basic slag, and on these the use of slag should not as a rule be departed from, except in a trial way, until the economic superiority of that which is to replace the slag has been established.

The Place of Potash and of Lime.

In some districts—for example, in parts of Taranaki and Southland—official trials have given indication of definite improvement from the use of potash on grassland. In districts in which such results have been obtained fairly extensive trial use of potash at least is justified. Apart from the particular districts in which it has been noted that improvement of pastures has been associated with the use of potash, no field evidence which would justify recommending the use of potash in top-dressing generally has been obtained. The material known as "30 per cent. potash salts" is, as a rule, the most economical source of potash for grassland.

The view, based to some extent on hazy tradition, that there is necessarily concord between liming and sound farming, is not now accepted. In New Zealand liming of grassland has produced very diverse results; sometimes liming brings about striking improvement and is obviously advisable; at other times it gives no apparent effect. In some instances, indeed, it appears to have a depressing effect, especially when used in conjunction with the slowly acting phosphates, and occasionally even when used in conjunction with superphospahte. In view of this, liming should be based on evidence of its bringing about profitable benefit under local comparable conditions.

Liming by itself is seldom financially attractive and so it is inadvisable, as a rule, to substitute the use of lime for the use of such artificial fertilizers as superphosphate and basic slag, the value of which already has been conclusively established. But if such artificial manures are not giving satisfactory results, the trial use of lime in conjunction with these is well justified. Normally, at the present time, a dressing of a few hundredweights an acre of lime is preferred to the much heavier dressing that found some favour in the past. As difficult times bring about a search for economy, increased current importance attaches to the fact that liming as a cheap alternative to other top-dressing of proved value is as a rule false economy.

Autumn Management of Grassland.

Coarse, mature, woody herbage may remain on pastures from the summer period of rapid growth. As a rule, such growth should be removed in the autumn; it delays the ready development of the fresh leafy condition which at this season characterizes fields which have been well grazed throughout the year. If it is not practicable to utilize store stock for the removal of the tall mature growth, then it becomes advisable to remove it by "topping" with the mower.

Harrowing of pastures as a means of properly distributing animal droppings is widely advisable in March. The thorough distribution that is desirable usually calls for two harrowings. One harrowing at right angles to the other is more effective than two harrowings in the same direction around the field. Grass harrowing also at times is advisable for the purpose of breaking up a matted compact sward.

When the area that it is practicable to top-dress is limited a special endeavour should be made to top-dress newly established pastures—it is likely to be more economical to prevent early deterioration of

young pastures by means of suitable top-dressing than later to renovate swards which have suffered because of insufficient fertility in their early stages.

The Cereal Crops.

In the autumn much important work with cereal crops demands attention. During recent years valuable additions have been made to our knowledge relative to such work, and information about the most effective known practices may be obtained from district offices of the Fields Division.

Because firmness is desirable in the seed-bed for wheat it often becomes possible to dispense with ploughing when wheat is to follow potatoes or peas, thorough disking being sufficient. When wheat is to follow pasture, skim ploughing should be done early in the autumn, and if it has not already been done, it should be proceeded with as quickly as possible. After the skimmed furrows have been exposed to weathering for six to eight weeks they should be disked and the land then ploughed to the full depth. When wheat follows a previous cereal crop, the stubble should be disked or grubbed and the land later ploughed to full depth.

In the main wheat-growing districts of the South Island autumn or early winter sowing should be practised whenever possible. In the most southerly wheat areas and in the North Island spring sowing is usually most suitable.

Oats to be used for the production of winter and early spring feed and subsequently to be allowed to develop for grain or chaff should be sown in April or in early May. The proved kinds of Gartons are the best all-round type for the South Island. Algerians are deservedly popular for the production of green feed and for the provision of good chaff. Gartons which do not stand grazing to the same extent as Algerians should be fed off once only and that quickly. When barley and Algerian oats are grown primarily for green feed, a succession of grazings when the growth is relatively low usually proves preferable to a single feeding-off of tall growth. The grazing of short growth lessens waste by trampling, and the feed provided is more attractive.

For autumn sowing of cereals clods on the surface are desirable rather than undesirable—they tend to provide shelter for the seedlings and to check the setting into a hard layer of the surface soil.

Extensive investigation has shown that over wide areas in the South Island the use of 1 cwt. an acre of superphosphate with wheat gives profitable results, and much the greater portion of the South Island wheat crop is manured in conformity with this finding. As a general rule autumn-sown oats and barley will respond profitably to an application of from 1 cwt. to 2 cwt. an acre of manure of which superphosphate is the principal constituent.

Widespread diseases of wheat, oats, and barley may be controlled by suitable treatment of the seed prior to sowing. Appropriate treatment of seed oats and barley is not carried out so generally as treatment of seed wheat, but there is just as much need for it in the case of any crop that may possibly be harvested for chaff or grain. Neglect of the treatment of Algerian oats seems at times to arise from the belief that it is free from attacks of smut to which it is just as subject as are other varieties of oats. Additional results of research work relative to treatment of seeds of cereals are now becoming available. Full particulars of these may be obtained from local officers of the Fields Division.

General Crop Work.

If early frosts have not already injured such crops as maize and millet, they should be turned into silage or hay. Silage should be made in preference to hay if the amount of green material available is not so small as to lead to undue wastage in silage; it is somewhat difficult to dry safely the relatively coarse stalks of these crops.

Swedes attacked to any considerable extent with dry-rot should be fed without any avoidable delay.

Autumn management of lucerne is of importance. At times the growth made during the latter part of the season is grazed. In the interests of the lucerne such grazing is usually inadvisable as the trampling that results favours the entrance of grass. This is particularly true of districts of good rainfall in which grass is at times one of the worst weeds invading lucerne.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Fruit Export Work.

FROM now until the end of the export season, the harvesting of mid-season varieties of apples and pears will allow for little time or thought for any other work than the picking, packing, grading, &c., of fruit for shipment overseas. In picking fruit for export there are three main essentials that must be kept prominently in mind—namely, colour requirements, stage of maturity, and size. Under no consideration should one be sacrificed for the other. When the fruit has attained the proper degree of maturity for picking for export no time should be lost in removing it from the tree, neither should any time be lost in packing and despatching. Once removed from the tree the fruit quickly matures. If it is allowed to remain in the shed too long either before or after packing the fruit may become over-mature for export. Pears especially should suffer as little delay as possible between picking and despatch. The overlapping of varieties, which unfortunately cannot be avoided, is apt to lead to trouble owing to the natural tendency to hurriedly finish with one variety before commencing another. This practice should and must be discouraged, as it often leads to rejection at the inspection point owing to lack of colour and immaturity. It is advisable to leave the final picking of a variety until the remaining fruit has sufficiently matured and coloured. In the meanwhile the first and perhaps the second picking of the overlapping variety can be gone on with. A word of warning which should not be ignored was sounded in the January notes regarding the rough handling of fruit for export and for local markets.

Cool Storing for Local Market.

Fruit intended for cool store for the local market should receive the same careful handling and consideration as that given to fruit intended for export. It should be carefully graded and packed, and placed in storage with as little delay as possible. The need for rejecting all fruit unsuitable for storage cannot be overemphasized — that is, all fruit showing bitter-pit, skin-puncture, skin broken at stem, windfalls, and those carrying an excessive amount of black spot—*i.e.*, one square inch in the aggregate. Fruit with a broken skin should be rejected because rots are likely to develop in the damaged tissues and cause much wastage in the fruit.

Ordinary Storage of Fruit.

Although fruit cannot be kept in ordinary orchard stores for such a long period as in cool stores, the practice of storing fruit in the former is quite satisfactory in so far as fruit which otherwise would reach a glutted market can be kept for several months without undue loss. It is, of course, imperative that the same careful handling, grading, and packing be observed as that for cool storage. Good ventilation is most important. The damage caused by rats and mice to fruit in ordinary storage may be considerably reduced if a good cat is kept in the store.

Seasonal Spraying for Pome Fruits.

Owing to the danger of late infections of black-spot and powdery-mildew it is advisable to apply one or more dressings of the combination spray as specified below to late varieties. The actual number of applications necessary will depend on the prevailing climatic conditions in each district. Late black-spot infection will result in what is termed a pin-head black-spot, which is sufficient not only to debar such fruit from export but to reduce it on the local market to a grade below second grade. Codling moth and leaf-roller caterpillar may also cause considerable damage to fruit crops. For the control of these diseases and pests apply lime-sulphur 0·083 per cent. plus colloidal sulphur 2 lb. and lead arsenate 1½ lb. (powder) in 100 gallons spray. Bordeaux 3–4–50 is recommended for pears.

Seasonal Spraying for Stone Fruits.

About two or three weeks after first picking, trees of stone fruits should receive a dressing of the following combination spray: Lime-sulphur 0·083 per cent., plus colloidal sulphur 2 lb. to 100 gallons spray. Should black and green aphis appear it is advisable to apply a 1-per-cent. summer-oil spray and to repeat in four or five days if insects persist.

For leaf-roller caterpillar on plums and cherries, it is advisable to apply 1 lb. lead arsenate plus 3 lb. hydrated lime per 100 gallons water.

Should leaf-roller caterpillar be present on peaches, nectarines, or apricots, one or two 1-per-cent. summer-oil sprays should be used, as these trees will not tolerate arsenates.

—J. W. Whelan, Orchard Instructor, Palmerston North.

Citrus Culture.

Ordinary routine work in all citrus orchards should be carried out, such as cultivation and sowing of cover crops where necessary. The recent rains should cause these to come away rapidly. It may at times be difficult to know what to sow; however, there are quite a number of legumes that do quite well in most localities such as lupins, peas, vetches, and horse beans. It is of primary importance that some means be employed to keep the soil well supplied with organic matter, otherwise trees and plants cannot thrive.

Before sowing such crops, the soil should be worked so as to provide for the removal of any surplus water that may fall. This is easily done so long as the soil is worked towards the trees, and after sowing a furrow is drawn down the centre of each row with the slope of the land. Stagnant water is very detrimental to citrus trees, and should always be guarded against.

A few words giving a simple outline of some methods to follow in order to cure lemons without going to a great deal of expense may be timely.

The lemons should be cut from the tree, close up to the button, leaving no stalk to scratch other fruit. It is advisable to harvest when the lemons are of commercial size irrespective of colour and to separate the green from the yellow lemons, as they behave differently in curing. It is advisable to convey them to the shed in flat boxes or trays and to avoid bruising and scratching. If damp or sappy they should be spread on a table to dry for twenty-four hours.

They should be placed on shelves in dry sand, chaff, or sawdust, or packed in kerosene cases, and kept in a cool well-ventilated shed.

If these few precautions are taken the amateur grower should not have any difficulty in curing his own lemons.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

The Culling of Poultry and the Selecting of Breeding-hens.

BEFORE beginning to cull a pen of birds, the operator should know, and give due consideration to, the conditions under which they have been kept, and also the age of the birds he is about to examine. For instance, if the flock has been subjected to a sudden change of feed especially during December or January, many good birds may have been driven into a moult, and the same thing is likely to happen if the flock has been underfed. In fact, when a large percentage of a flock ceases laying and goes into a moult before the New Year, it is usually a case of underfeeding. Birds that were in houses where artificial light was used last autumn and winter will usually moult a little earlier than others. Again, the age of the birds must be considered, for, generally speaking, yearling hens that began laying in February of last year can hardly be expected to lay so late into the autumn as the second-year hens that did not begin laying until about August last, as the latter were moulting during last autumn. It is better that the different ages be kept separate, or, where this is not practicable, that they be marked.

The most business-like and profitable plan is to cull regularly throughout the year and get rid of the unprofitable birds as soon as they can be detected. This not only keeps the flock on a better paying basis but also allows more room for the growing stock. However, the best time to select breeding-stock is during February and March, before many good birds have begun to moult. In the culling of a mixed flock the following matters are worthy of attention :—

(1) Most birds that are two and a half years old and over should be put out as soon as they stop laying, for after the majority of hens have been through two laying seasons they are usually no longer profitable commercial egg-producers. However, if some of the two-and-a-half-year-old hens are of exceptional breed and type and still show vigour and activity, they should undoubtedly be retained for the breeding-pen. Experience has shown that from a good flock of birds about 15 per cent. of these two-and-a-half-year-olds are fit to be retained for another breeding season.

(2) The first birds of a given age to moult should be culled, for such birds are usually those of weaker constitution. The last birds to moult in a flock are generally the strongest and best producers.

(3) Any overfat or exceptionally heavy hens for the breed they represent may also be culled ; the fact of their becoming overfat indicates that they are probably poor in respect to egg-production, for the exceptionally heavy hen is seldom a good producer. Overfat Leghorns can usually be picked by their yellow legs and beak at this time of year.

(4) Birds showing want of vigour and vitality should be culled. These can be picked out by their want of activity and, generally, looseness of feather, also dullness of head and eye. Physical activity is one, if not the chief evidence of constitution and health. Slow-moving or sluggish birds are never heavy producers. The hen that is constantly hunting for food and never seems satisfied with what is given her is usually amongst the best layers in the flock. The big eaters are, as a rule, the layers ; they go to roost late and are the first off in the morning. With layers, increased food consumption means increased egg-production. and failing appetities a poorer egg yield. It therefore follows that the great egg-producers have a good crop capacity and as they are digesting a large quantity of food they usually possess a good depth of abdomen—in fact the deepest part of a good layer's frame is straight down from where the tail comes out of the body, and the legs will be well back and set well apart. The head

points can hardly be overestimated when selecting layers. The best layers' heads are usually inclined to be rather long for the breed they represent, fairly fine, but showing strength and character. The small, round sparrow or pigeon-headed bird generally belongs to the poor producer.

The comb of the hen which is laying heavily is of a rather pale red colour and has a warm waxy feeling. It should be of medium size and thickness, not coarse but not flabby, and with good layers the comb usually follows the line of the head and seldom does one find the best layers with a comb sticking up at the back. The wattles should be fine in texture and carried fairly close together, the eyes large, in fact the larger the better, also bright and prominent. The eyeball of the best layers, especially with heavy breeds, is generally situated a little back from the centre, whereas with the poor producer it is more towards the front of the socket and sunken.

Feathering is of importance. The strongest and best birds are usually closely and tightly feathered. Softness and looseness of feather generally belong to the coarse bird of slow maturity and low production. It will also be observed that the birds which show lack of confidence and which are nervous or wild, and those that remain at the back of the flock at feeding-time, are not amongst the best birds, but the best are often amongst those which are neither too tame nor too wild, and which are not easy to catch.

When culling Leghorns or any of the yellow-fleshed birds, the leg and beak colour are good guides to production. As a rule, when well-reared Leghorn pullets start to lay they have yellow legs and beaks, but as they continue laying the colour fades, first from the beak, then from the legs, so if one finds Leghorn hens at this time of the year with yellow legs and beaks it may be taken for granted that such birds have not done much laying for some time, and should be culled.

After a flock has been culled, the best of those remaining should be selected for the breeding-pen; and as the breeding-hen is the foundation of the poultry industry, a poultryman's success will depend largely on the care taken and knowledge shown in this branch of work. The three great essentials to keep in mind when selecting breeding-stock are (1) purity of blood; (2) vigour and constitution; (3) capacity to produce and reproduce. Purity of blood is mentioned first, for a poultryman can hardly expect to make much lasting progress if he breeds from mongrel stock, and has no definite standard at which to aim. It is also very desirable to know something of the history or pedigree of the birds to be bred from. A pure line from parents that have been noted for constitution and the production of good-sized eggs that produce good liveable chicks is what is needed.

The chief characteristics of the best birds will be approximately as follows: *Head* fairly fine, showing strength and character, not coarse, but rather wide at the top, and of fair length. As before mentioned, low value is attached to the small, round, sparrow- or pigeon-headed birds. *Comb* of medium size and thickness, but not coarse or flabby. *Wattles of* medium size, fine in texture, and carried close together. *Feathering* hard, tight, and dense, and often of a worn threadbare appearance, while many good Leghorns have a more or less straw-like tinge in the feather at this time of the year. *Body* will show length, depth, and width, with a good crop capacity and depth of abdomen; back rather flat with width carried well back to the tail. The texture of the abdomen should be fine, silky, and flexible to the touch. This is a most important point. Legs of a medium length carried well back, and wide apart. *Size:* It is well to keep a close eye on this point, for, as a general rule, the tendency is for the average size of a poultryman's birds to get smaller. In fact, some poultry-keepers consider that a bird must be on the small size to be a good layer. The sooner, however, that we all realize that smallness is not the cause of good egg-production, but its effect, the better it will be for the

industry. It is desirable that Leghorn hens that are picked as breeders weigh, say, from 4 lb. to 4¾ lb. for eighteen-months-old birds, and 4½ lb. to 5½ lb. each for two-and-a-half-year-old birds.

It is not often that the very early layer makes the best breeders, which are generally a little larger than the very best layers in the flock, and come from those that develop their frames first and the internal organs after.

There is a tendency with many poultry-keepers when selecting their breeding-hens to go for numbers, often at the expense of quality. This, is a great mistake.

Years of experience show that to get 40 per cent. of breeders from a good flock of eighteen-months-old birds is doing very well.

—C. Cussen, Poultry Instructor, Christchurch.

THE APIARY.

Preparations for Winter.

THE time is at hand when it is of paramount importance that proper preparation be made for winter in the apiary. If the colonies are to winter in good order, so as to escape the abnormal losses which sometimes occur, then it behoves the beekeeper to attend to the leading factors that ensure successful wintering. The attendant evils of neglect are starvation, spring dwindling, and poor colonies, these latter being of little account when the next season's flow arrives. Among the most important factors which make for success are a strong cluster of bees, a good queen, plenty of good stores, and protection.

It is safe to say that too little attention is paid to wintering the colonies with strong clusters of young bees. Having secured a crop of honey, and noting that the colonies are strong in bees, the beekeeper is often satisfied to trust to chance. At the close of the season the colonies are likely to contain a large force of bees, but the majority, having helped to gather the season's crop, are old, and in consequence cannot be taken into account in wintering. As a result, unless large numbers of young bees are being raised to take the place of the old stock, the colonies will dwindle seriously in the spring, or become a total loss in winter. Every effort must be made to keep up breeding well into the winter, and it is often advantageous to stimulate the colonies by autumn feeding.

Next in importance is the necessity for the colony to be headed by a good queen. Too little attention is paid to superseding failing queens. A queen that has laid vigorously during the honey season is likely to become worn out and her powers of reproduction diminished. In all cases such queens should be replaced and a vigorous young mother supplied. It often happens that the bees recognize a failing queen and set to work to supersede her, but this work should be anticipated by the beekeeper. Other things being equal, stocks headed by a vigorous mother are likely to keep up late breeding, with a result that the colonies will come out in the spring with a prolific queen, and the bees attendant upon queenless hives will be greatly diminished.

If the beekeeper studies his interests and the welfare of his bees, he will ensure that every colony goes into winter quarters with plenty of good stores. This is a most important factor, and upon it depends largely the staving-off of starvation which faces the bees during the months which follow. The colonies that are supplied with honey winter safely, build

up early in the spring, and are ready to take advantage of the nectar from the early-flowering plants. Beginners often ask how much honey should be left for the bees to winter on. The amount necessary must to some extent depend largely upon locality, and care must be exercised, more particularly in the South, to provide sufficient food so that winter feeding may not have to be resorted to. In the North winter feeding may be successfully carried out, as there is not the same risk in breaking up the clusters as there is in the extreme South. In no case should a colony be left with less than 30 lb. of sealed honey, and it is wise to increase this amount to 40 lb.' Abundance of stores is essential if winter losses are to be eliminated altogether.

Another important factor in safe wintering is that of protection. This may be provided by housing the bees in good watertight hives, and protecting them by good shelter hedges or fences. Great winter losses occur every year in this country through lack of attention to the hives, more particularly to the roofs. Leaky roofs should not be tolerated under any circumstances. By allowing the roofs to leak the mats and hives become damp, and the consequent drain on the stores is largely in order to keep up the heat of the cluster for safe wintering. Where the bees are kept dry the amount of food consumed to keep up the heat of the cluster will be small as compared with the stores eaten where proper protection has not been afforded by the beekeeper. New Zealand in general being a wind-swept country, it behoves the beekeeper to see that the bees are located in a sheltered position. Cold winds militate against brood-rearing, and also prevent the bees from taking a cleansing flight during the spring months.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

THE present time is the harvest period for these crops in a special sense, and by carefully considering the merits of each they can be used to best advantage. Correspondence shows many crops are seriously injured or lost just for the want of careful inspection when harvesting and consideration in storage.

Harvesting and storing main crops of onions and gourds were dealt with last month. The late potato crop will now be one of the most important receiving attention. Digging is generally best done promptly in fine weather when the land is dry as soon as the crop shows signs of ripening. Delay may mean a second growth, or spread of disease or pests from the tops to the tubers as the former die down. The season generally has been dry, and, as is to be expected, reports of serious loss from the attack of potato-moth have been received. Where this pest is present, or likely to be, the precautions mentioned in the December number of the *Journal* must be carefully observed, or the pest will increase in storage and the tubers be riddled with larvæ. To keep potatoes in condition they should be stored in a shed or pit that is dark, cool, but frost-free, and ventilated. In a shed they may be in sacks or piled in bins. To pit them, well-drained ground in a cool position should be chosen. The pit is dug but a few inches deep, 5 ft. or 6 ft. wide, and as long as necessary, placing the soil in equal ridges on each side. The potatoes are then tipped and piled as high as possible in a long ridge. The sides are then covered to a depth of 6 in. with straw or fern, and this is then covered with soil, 3 in. deep, to within a foot of the ridge. After an interval of a month

or six weeks, when the respiration of the tubers has declined, the soil covering may be completed and increased to a depth of about 6 in. For long storage the crop should be definitely sound; where the condition is mixed, or even where the potatoes have been carefully picked over, it is advisable they should be used up without delay. Seed potatoes should be kept in a shed, as described above, except that a certain amount of light is beneficial. They may be boxed, and for early varieties and small quantities this is generally most convenient. The danger of attack by the potato-moth should be watched; in most districts this passes during the month of May.

In the warmer districts, especially where there is a fair to heavy rainfall, the ordinary potato crop is rather difficult; but the sweet potato, or kumara, generally grows well—for this and other reasons it is increasing in popularity in such areas. While the crop is best left growing as late as possible, it must be lifted before there is any frost, or the tubers immediately under the crown are liable to injury. If frost kills the vines the kumara should be dug immediately, as decay sets in on the dead vines and may pass down to the roots. Digging must be done with the greatest care, as the slightest damage at this stage prevents the tubers keeping; storage losses are chiefly due to faulty handling before curing. The last-mentioned operation is usually done by gathering the kumaras into heaps and sweating them for a week before storing them. They may be stored in sand so long as it is perfectly dry, but boxes are perhaps most suitable for small quantities for one's own use.

In America, the home of the kumara, a great deal of interest has been taken in working out good storage methods. The main features are warm, dry, well-ventilated chambers. Fires are started in stoves two or three days before digging to heat and dry the storage-house. Crates filled with tubers are then stacked in a chamber in a way that permits ample ventilation and circulation of the air all round them, and as soon as it is full the doors are closed and the temperature is raised to 80° to 90° F. and kept there during the curing period. Humidity is kept as low as possible; it should never exceed 65 to 70 per cent. saturation. The time required for the treatment may be ten to fourteen days after the last tubers are stored. Common tests indicating that the kumaras have been sufficiently cured are said to be (1) non-slipping of the skin; (2) the appearance of purplish buds; and (3) the dry spongy character of the skin.

As soon as the kumaras are cured the temperature is lowered to 55° F. and kept near that point during the whole period of storage. Frequent errors in management are given as rough handling, storing crop infected with disease, allowing the fire to go out occasionally during curing, not guarding against rodents, permitting sudden changes of temperature, failing to ventilate in warm weather, and, finally, disturbing the produce before it is intended for immediate shipment. These points should receive consideration from those growing this crop for sale.

Other root crops reaching maturity now are parsnips, carrots, beet, salsify, and artichokes. In the cooler districts main crop carrots and beet are sown about the month of October and lifted now for winter use. If allowed to remain in the ground, carrots are inclined to split and the beet becomes coarse and loses flavour. Care is needed in trimming beet or they will lose colour when cooking. The leaves especially must not be removed too close to the crown; it is best to twist them off. In a clean, cool, ventilated shed that is sufficiently humid these roots keep well with little attention. Small quantities in places where they are inclined to dry out and shrivel will maintain their condition if kept in moist sand. In districts

sufficiently warm sowings of these roots may be made in early autumn when they may be left in the ground through the winter without injury and finally lifted in spring, before vigorous growth commences. Stored roots have by then been finished or are in poor condition, and the young fresh supplies are appreciated. Parsnips, salsify, and artichokes are best left in the ground over the winter and lifted as required. To avoid having to disturb the ground when wet it is often convenient to keep a moderate supply of these roots in sand.

The importation of haricot and lima beans indicates a considerable demand. It should be more generally known that almost any varieties of these beans are suitable for use in a similar way, but self-coloured seeds, such as the white, green, or various shades of brown, are preferred. Any dry beans in excess of those required for seed may be cooked, and it is a good plan, where the climate and soil are suitable, to make in season additional sowings for this purpose.

A piece of well-drained land in good heart should now be selected for planting in cabbage, cauliflower, and lettuce for spring cutting. These plants should be steadily established and not pushed with nitrates until spring growth commences naturally. The same crops may now be sown in seed-beds for planting out in early spring. Sow rather thinly so they do not hold water unduly, and, in colder districts especially, make the beds of such a size that they may be covered with a cold frame and the seedlings given protection in rough weather.

Preparing Land for Future Cropping.

Many people have an aversion to planning for the future; they prefer sudden spontaneous action carried out with enthusiasm and haste. This is very possibly a suitable procedure for undertakings of many kinds, but in undertakings horticultural it is the commonest and deadliest blight we have. Successful garden cropping over a long period at a moderate cost can only be done with an intimate recollection of past experience, consideration of present opportunities and demands, and also the possibilities of the future. It compels hard thinking, careful consideration, methodical planning, together with a watchfulness that is always ready to meet the vagaries of nature as far as possible. All undertakings of the kind that are important or in which one is interested should be done in this way, and the result cannot fail to be of value.

In the vegetable garden the labour will be less and the results better if the crops are classified and grown in a succession that will benefit the soil mechanically, chemically, and biologically, instead of making it barren. Market demand often seriously limits the different kinds of crops grown and a good classification is then difficult; under such circumstances it may be advisable, and where the land is light it certainly would, to lay down an area in grass and clover for a season or so to recuperate. The following grouping of crops is of practical value: (1) The group of plants known as Brassica includes the different kinds of cabbage, cauliflower, sprouts, kale, and turnips; they have common tastes as regards lime and a rather rich soil; they are also susceptible to similar diseases and pests. (2) A group not so closely allied to one another are those which are deep-rooting, such as carrots, beet, parsnips, &c. Fresh organic manure is injurious to all of these, as it encourages fibrous roots instead of the clean fleshy tap roots that are desirable. (3) A third group consists of peas, beans, salads, and other shallow-rooting crops that thrive on a generous diet.

Such a classification is the basis of most rotations, and, when adopted, greatly facilitates the work.

When a rotation based on this grouping is followed: (1) The land which carried shallow-rooting crops during the past season will now be trenched or double-ploughed for root crops. (2) Land in which roots are now standing will be heavily manured and dug as it becomes available in preparation for the Brassicas; preparation which includes, it should be remembered, a pound or so of finely ground limestone per square yard hoed in after digging. (3) The area at present carrying the winter crops of Brassicas, and to which the spring crop will shortly be added, will receive similar preparation, as it becomes available, omitting possibly the lime, in readiness for such shallow-rooting crops as peas, beans, and salads. By dividing the available area into three equal parts, systematic cropping on these lines will soon show an improvement. Such perennial crops as rhubarb, asparagus, small fruit, and herbs can very well have a plot to themselves in the home garden.

When new land has to be broken in for this class of cropping it must be done thoroughly or weeds are propagated instead of the land being cleaned. Two preliminary considerations are drainage and shelter. Desirable land for this work is often low-lying and drains, open or piped, are required. It is false economy to neglect this attention where it is really necessary. In some instances a good alluvial soil is over-drained by having a shingle subsoil, and in that case a water supply is an urgent consideration.

Good shelter is required by the heavy-bearing crops of the present day. Its position, extent, and composition must be carefully considered before planting, and it should be carefully tended afterwards, as no crop is more important. Useful temporary shelter may be made with manuka brush woven in wire or with strips of maize.

Cultivation should commence as early as possible, as it takes some time for the beneficial effects of drainage and cultivation to develop to any extent. Where the land is heavy and difficult it may even be necessary to confine the cropping to the bigger seeds and plants for the first season until a fine tilth is acquired.

Nut-culture.

New Zealand walnuts receive wide recognition on the local markets. The "meat" is easily extracted and of good flavour when the nuts have been well dried off. If they were put over riddles to eliminate waste and under-sized nuts, moderately hand-picked to remove empties, and gathered before they discoloured or washed to clean them, they would be quite a creditable product. Alluvial land in most of the drier districts is very suitable for the production of walnuts and almonds. As secondary shelter, shade, or as an avenue they are useful, in addition to the crop produced. It is important that the ground beneath the trees is smooth and well grazed or harvesting is difficult.

Cones of the stone pine, *Pinus pinea*, when spread in a warm place, quickly release the nuts they hold so tightly. On sheets of paper on the plate-rack over the kitchen stove is a good place for experimenting.

Chestnuts and hazels produce useful timber as well as nuts, and are less particular as to locality. Where these crops are to be harvested now the ground beneath the trees should be cleared and the nuts gathered at short intervals to prevent discoloration. A pole to shake the upper branches of the larger trees will be of great assistance. The nuts when gathered are then placed in trays and thoroughly dried before shipment or storage.

—*W. C. Hyde, Horticulturist, Wellington.*

WEATHER RECORDS: FEBRUARY, 1934.

Dominion Meteorological Office.

NOTES FOR FEBRUARY.

VERY dry conditions continued during February in Nelson and Marlborough. The spring and summer in those provinces have been the driest on record and come as the culminating point of four dry years. There is a very serious lack of moisture in the subsoil, and the question of winter feed for stock is causing great anxiety. The west coast of the South Island also experienced a very dry month. In Canterbury, though the rainfall was below average, the humid conditions delayed harvesting. Heavy rains were experienced in the North Island and were of enormous benefit to pastures.

Rainfall.—The only parts of the North Island which had less than the average rainfall were in central and northern Taranaki, the southern Waikato, and portions of the Auckland Peninsula. Much of the remainder had twice the average and many places considerably more than twice. The week from the 7th to the 13th was a particularly wet one, especially in the south Auckland, Bay of Plenty, Poverty Bay, Hawke's Bay, and central districts.

In the South Island, some parts of southern Marlborough, most of Otago, and the interior of South Canterbury recorded more than the average fall, the excesses being large in places in Central Otago. The rest of the Island had considerably less than normal.

Temperatures.—Except in Otago and Southland, temperatures were below normal, the departures being largest in eastern districts of the North Island.

Sunshine.—The amount of bright sunshine recorded did not differ greatly from normal. In the North Island it was rather less, but in most of the South Island rather more.

Pressure Systems.—There were two principal storm systems which affected New Zealand during the month, each of which commenced as a vigorous cyclone in the coastal area of Queensland and caused extensive flood rains in the eastern Australian States. In each, the eastward movement was very slow. The first appeared near Mackay on the 1st February, and, travelling slowly in a south-south-easterly direction, became a very deep and violent storm by the 4th, when it was situated west of the centre of the Tasman Sea. During this period there were easterly winds in northern New Zealand, and the unsettled weather which had prevailed there during the latter part of January was very slow in dissipating. After the 4th, the cyclone commenced to fill up. The remains of it passed over New Zealand as a complex trough of low pressure, which though shallow, was responsible between the 6th and 8th for a general rain, which was the best experienced during the month. The southerly wind which followed the depression on the 8th and 9th was very cold and boisterous. Conditions remained unsettled to the east and north until the 13th.

The second cyclone appeared on the central Queensland coast on the 20th and moved southward until, on the 24th, it had reached Tasmania. It there, like its predecessor, commenced to pass slowly eastward, at the same time filling up. A low-pressure trough lying in a north and south direction was left, however, over the Tasman Sea, and while it crossed the Dominion, between the 26th and 28th, fairly widespread rains fell. Each of these cyclones was preceded in the New Zealand area by a rather intense anticyclone.

In addition to the above-mentioned storms, moderate depressions passed between the 16th and 18th and the 20th and 21st respectively, but neither produced a great deal of rain.

Rainfalls for February, 1934, at Representative Stations.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.	Total for Year to Date.	Average for Year to Date.
			North Island.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	5·59	14	1·62	3·50	5·80	7·44
Russell	3·51	11	1·10	2·99	5·13	6·24
Whangarei	3·42	16	0·90	3·87	6·83	7·80
Auckland	8·17	18	2·16	3·12	9·74	5·84
Hamilton	3·08	12	1·01	2·91	6·07	6·48
Rotorua	7·43	12	1·96	3·69	10·40	7·95
Kawhia	4·40	8	1·55	2·86	9·85	6·41
New Plymouth ..	1·80	8	0·60	3·79	7·94	7·98
Riversdale, Inglewood ..	2·41	6	0·82	6·03	8·02	13·54
Whangamomona ..	..	..	..	3·89	..	9·47
Hawera	3·61	8	1·99	2·40	7·37	5·91
Tairua	6·70	14	1·12	4·68	7·57	8·34
Tauranga	8·37	12	2·11	3·51	10·45	7·59
Maraehako Station, Opotiki	6·77	13	2·18	4·14	8·17	7·73
Gisborne	4·89	11	1·78	3·46	7·17	6·18
Taupo	8·38	10	2·73	2·74	10·40	6·11
Napier	6·97	12	2·40	2·78	9·90	5·71
Hastings	5·86	11	2·35	2·25	7·85	4·18
Whakarara Station ..	..	..	..	..	..	..
Taihape	5·20	11	1·70	2·19	7·60	5·39
Masterton	..	..	..	2·73	..	5·33
Patea	..	..	..	2·40	..	5·99
Wanganui	4·88	9	2·18	2·42	9·46	5·25
Foxton	2·76	8	1·02	2·07	4·93	4·21
Wellington	3·51	11	1·33	2·67	5·54	5·48
			South Island.			
Westport	1·05	8	0·33	5·35	11·35	13·55
Greymouth	2·23	9	0·50	6·21	10·96	15·38
Hokitika	3·60	12	0·94	7·19	11·80	17·26
Ross	4·71	10	1·26	8·90	16·86	21·30
Arthur's Pass ..	2·72	9	1·05	9·90	17·69	24·02
Okuru, South Westland	2·46	6	..	9·66	..	22·25
Collingwood	3·21	10	1·13	5·13	6·41	11·71
Nelson	2·37	10	1·43	2·63	3·11	5·44
Spring Creek, Blenheim	0·94	7	0·33	2·18	1·74	4·40
Hanmer Springs ..	4·29	9	1·22	3·20	11·71	7·10
Highfield, Waiau ..	1·52	8	0·51	2·60	6·87	5·58
Gore Bay	1·83	12	0·65	2·80	6·66	5·26
Christchurch	1·53	11	0·62	1·74	4·97	3·92
Timaru	1·42	6	0·55	1·84	8·64	4·11
Lambrook Station, Fairlie	2·27	6	0·79	1·81	6·86	4·24
Benmore Station, Clearburn	2·17	9	1·00	1·62	3·68	4·39
Oamaru	2·19	7	0·60	1·79	5·88	3·83
Queenstown	..	..	..	1·94	..	4·86
Clyde	2·18	8	0·76	1·06	3·86	2·91
Dunedin	2·74	9	0·86	2·73	7·82	6·16
Wendon	2·28	7	0·77	2·26	4·45	5·46
Gore	..	..	..	2·65	..	5·73
Invercargill	2·11	10	0·80	3·12	5·79	7·13
Puysegur Point ..	2·46	14	0·70	5·74	8·96	13·36
Half-moon Bay ..	..	..	..	4·08	..	8·90

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

CONCRETE FOOT-ROT RACE.

B. H. T., Little Pigeon Bay, Canterbury.

I should be glad if you would give me shape and dimensions of a good concrete foot-rot race for sheep.

The Live-stock Division :—

The foot-bath should be in the form of a trough, 12 ft. long, 18 in. wide, and 6 in. high, the rails being placed in such a position as to act as guides into the race. If large numbers of sheep are to be treated a portion of the yard may be railed off and concreted, with the edges of the concrete raised a few inches to hold the solution.

USE OF SILAGE.

M. W. N., Portage Road, New Lynn :—

How soon after making may silage be fed out from a concrete silo. If it is found unnecessary to continue until all used, should the weights or a cover be applied again ?

The Fields Division :—

It is usually considered that silage should be left a month before feeding out, but when, in cases of emergency, feeding-out is commenced almost immediately after ensiling no bad effects have been noticed. In practice it is very seldom necessary to feed out before one month has elapsed, and so not much experience has been gained on that point. If it is found necessary to continue until all is used, it will pay to apply a thin covering (about 6 in.) of earth to seal the silage. Otherwise waste will occur from 1 ft. or more in depth. Weights, unless they make a complete seal from the air, would not be of much use.

RELATIVE VISION.

C. G. S. O'B., Murchison :—

Which has the longer vision, and also the most distinct, man, horse, or dog ?

The Live-stock Division :—

Man has undoubtedly the longest and most distinct vision when compared with dogs and horses, but not when compared with certain birds. The dog actually sees acutely at a very short distance and relies to a great extent on general movement and scent to recognize his master (for example). A horse has a different type of vision from man and the dog, and is therefore not good at judging distance, but, on the other hand, it sees more in a general way than does the dog. One would place distinctness of vision in the order of man, dog, horse ; but length of vision as man, horse, and dog.

TREATING HORSE'S "SEEDY TOE."

"XYZ," Fairlie :—

Can you advise me of a satisfactory method of curing a horse's hoof which is hollow ? The hock above is inflamed.

The Live-stock Division :—

The horse's hoof is affected with what is known as a seedy toe. This is a condition in which the wall of the hoof becomes separated from the underlying

sensitive structure. Although it is commonly situated at the toe it may occur at any part of the wall of the foot. Pressure of some sort is usually considered to be responsible for producing seedy toe, a very common cause being a tightly hammered back toe clip, but in some cases the cause is obscure. Treatment: The diseased horn should be pared away by means of a narrow-bladed knife, known as a searcher. When all the soft friable horn is removed swab out the cavity with strong tincture of iodine and then pack the cavity with tow soaked in Stockholm tar, keeping this in place by a leather sole fitted under the shoe. A blister applied to the hoof-head above the cavity often helps to stimulate the growth of new horn, but it must be remembered that a bad seedy toe requires attention for a considerable period. Keep the horse away from dirty wet places as much as possible, and repeat the dressing every three or four weeks.

MASS ARTIFICAL INSEMINATION.

A. M. W., Ngatapa, Gisborne :—

I read recently about the mass artificial fecundation of dairy cattle in Russia by which means one good bull serves up to two thousand cows per year; by means of thyroid extract it can be arranged that all the cows to be served are simultaneously on heat when the semen arrives; the percentage of calves produced being well over 90 per cent. Can you tell me if (*a*) artificial insemination has ever been successfully carried out in New Zealand, and (*b*) where can thyroid extract be obtained, and how it is administered.

The Live-stock Division :—

(*a*) Artificial insemination has been carried out successfully at Wallaceville on individual cases, but no mass production of œstrum has been attempted. (*b*) Thyroid extract can be obtained from drug warehouses. It is generally administered by mouth, being one of the few organic therapeutic substances which can be relied upon to act by way of the mouth. There is considerable doubt, however, as to its efficacy if one desires to bring all cows into œstrum at once.

CONTAGIOUS ABORTION TREATMENT.

B. N., Taradale :—

Last season I had a cow and a heifer that slipped their calves at seven months, the heifer went to the butcher and the cow I had washed out three times, once with corrosive sublimate and twice with Condy's fluid. She is now in calf and gone five months. Kindly let me know what disinfectant to use to to prevent abortion. To-day I have a heifer slipping her calf at six months. I enclose an alleged abortion cure. Is it worth while to try it?

The Live-stock Division :—

Contagious abortion in cattle is a slow chronic inflammation of the membranes surrounding the unborn calf which eventually results in expulsion of the fœtus. One attack confers a certain degree of immunity. Heifers on this account are more subject to the act of abortion as they have not developed any immunity. While the infection remains on the farm heifers are liable to contract the disease as soon as they become pregnant. In the absence, therefore, of complete eradication of the infection it is more advisable to retain the heifers in the herd than to dispose of same to the butcher. By retaining the heifers in the herd a certain amount of natural immunity is conferred by each attack. Complete eradication of the disease from a herd can be carried out by blood-testing and elimination of all reactors, and by blood-testing all animals prior to their introduction to the herd. Carbolic acid has been known and used over a long period of years both as a cure and preventive of contagious-abortion disease. I have no evidence that this antiseptic will either prevent or cure abortion. The evidence in the enclosed cutting is not convincing, as cows develop an immunity irrespective of being dosed with any antiseptic. The use of carbolic acid either as a cure or preventive cannot therefore be recommended.